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HYBRID GRAY SCALE OPTICAL/DIGITAL CORRELATOR

AD-A196 300

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Advanced Sensors Directorate
Research, Development, and
Engineering Directorate

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U.S. ARMY MISSILE COMMAND

Redstone Arsenal, Alabama 35898-5000

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The report describes the architecture and major components of a hybrid optical/digital correlator which makes use of the reference gray scale for image pattern recognition. The specifics of the electronic/optical design are presented in schematic diagrams. Software listings are included for system test and alignment including a host interface. Operational notes are included.

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ACKNOWLEDGEMENT

The authors would like to recognize the significant contributions of Tom Stroud and Allen Davis in layout, fabrication, and debugging of this testbed.

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I. INTRODUCTION

The two dimensional optical processing techniques using one dimensional input devices discussed by Demetri Psaltis [1,2] in several of his papers were used as a starting point for the following hybrid design. Graeme Duthie's knowledge of the Psaltis research instigated this work while he was at the U.S. Army Missile Command.

This design approach breaks out of the binary correlation world previously implemented in hybrid systems to use some of the dynamic range capabilities of the light emitting diodes and charge couple device (CCD) arrays. It also makes use of the strong points of both optical and digital correlators and bypasses some of their shortcomings.

II. SYSTEM ARCHITECTURE

The major components of the system are depicted in Figure 1. A photograph of the optical bench is presented in Figure 2. Top and front views of the electronic rack are shown in Figures 3 and 4. The electronic rack layout with a front panel view is shown in Figure 5, and schematics of the digital control cards are in Figures 6, 7 and 8. Schematics for ADC/Video processing, the correlator reference memory, and LED driver card are shown in Figures 9, 10, and 11. There are two CCD TV cameras used. The first camera is to image the input scene, and the other is for collecting and generating the output correlation surface. The acoustooptic cell (AOC) receives input from a fixture of 64 fiber optic filaments in a linear array and from the input camera video. The fiber optic filaments are attached to a light emitting diode (LED) array being modulated by the digital reference memory. Each LED transmits a single image line from the reference array. The reference memory is interfaced to a host computer for testing purposes. The video of the input camera, while in reference store mode, is typically used to generate a reference image via the analog to digital (A/D) converter in a single field time. In normal operation the input camera video is converted for input to the AO cell only.

A. Video Source

The input video camera is a NEC TI22AII/22PII CCD camera. The video is in standard RS170A format scanning 490 vertical and 384 horizontal picture elements (pixels). The video is not direct current restored, requiring additional circuity prior to the analog to digital converter stage.

B. Acoustooptic Cell

The AO cell is made up of two major components, the modulator driver, and the large aperture high resolution Bragg cell. The Bragg cell aperture time is 70 microseconds (μs), approximately 7.5 μs longer than one TV line.

The AO cell needed a one-volt (V) analog source requiring a clipping circuit to takeoff the video sync. This circuit is shown in Figure 9.

The reference illumination over the AO cell window during every horizontal blanking time provides a convolution in the horizontal direction over each line in the source video image.

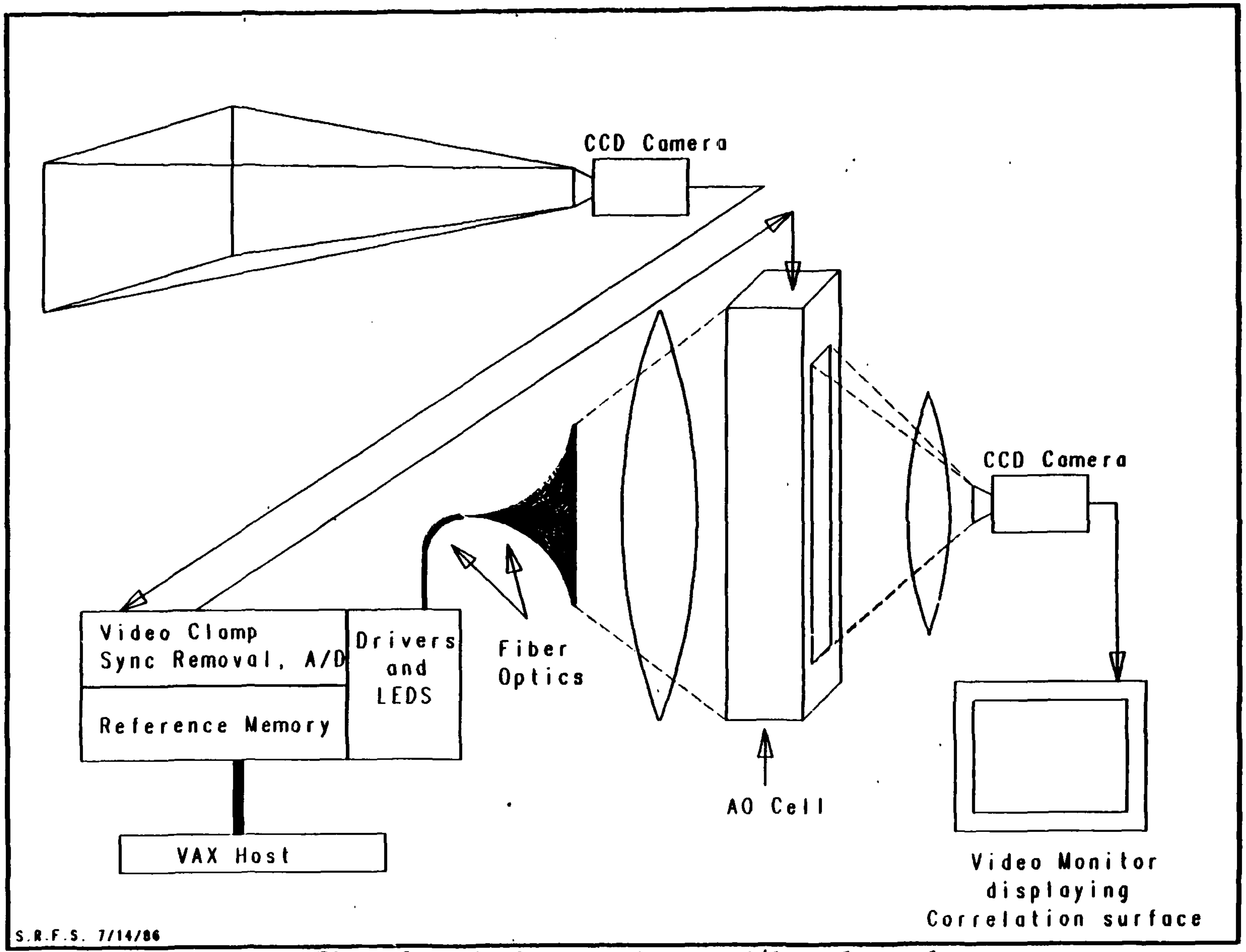


Figure 1. Hybrid gray scale optical/digital correlator-functional block diagram.

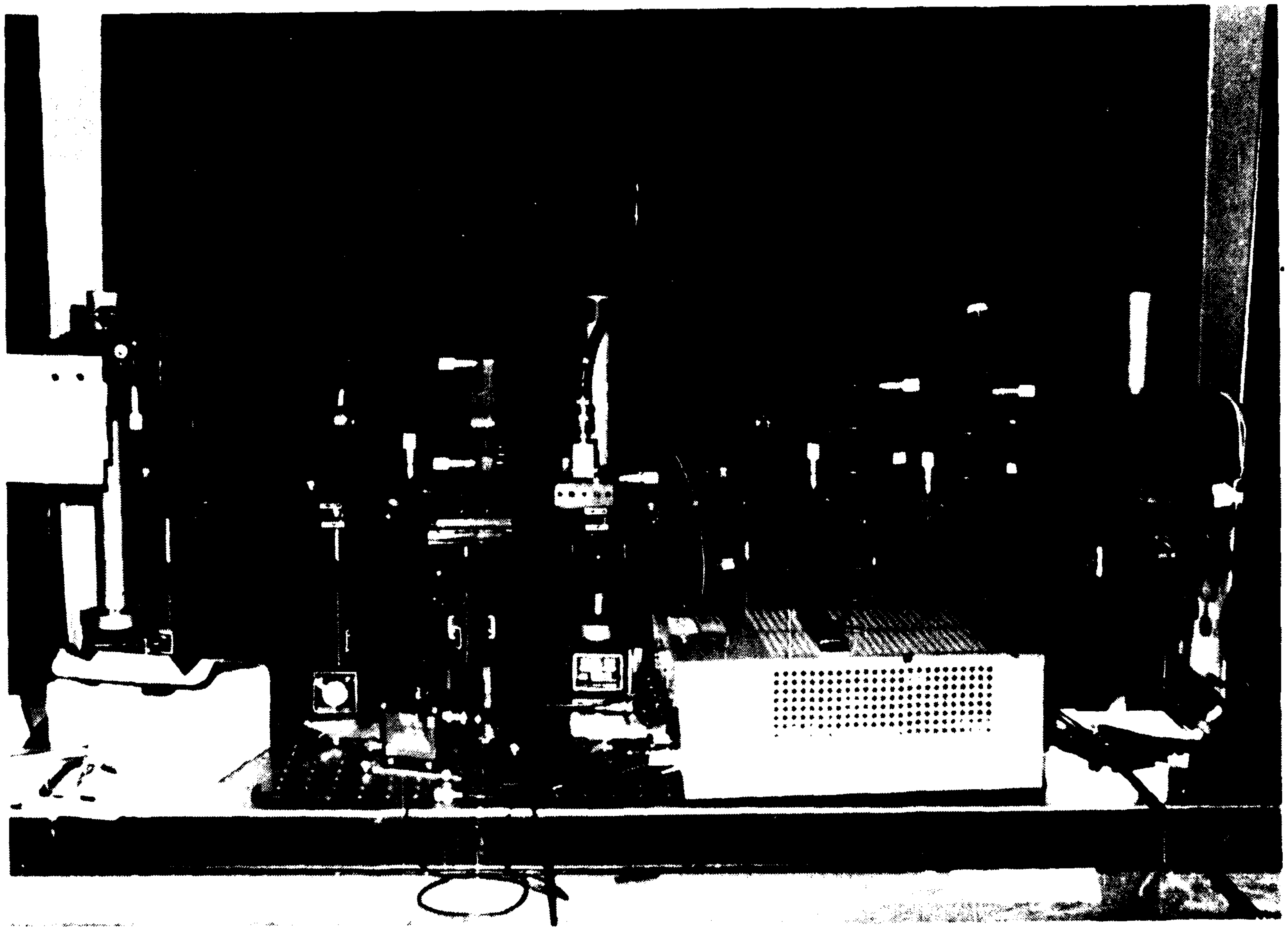


Figure 2. Optical bench.

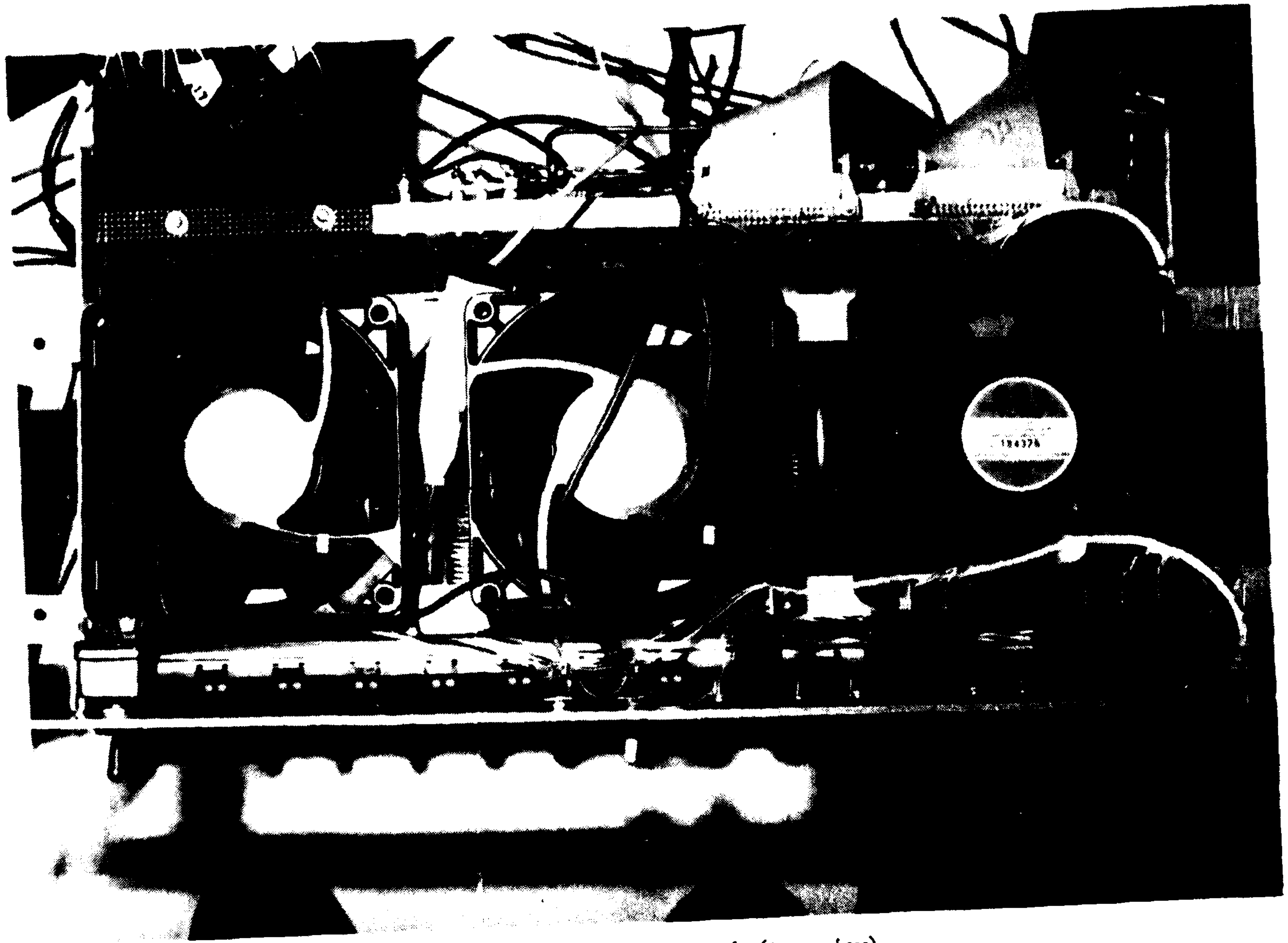


Figure 3. Electronic rack (top view).

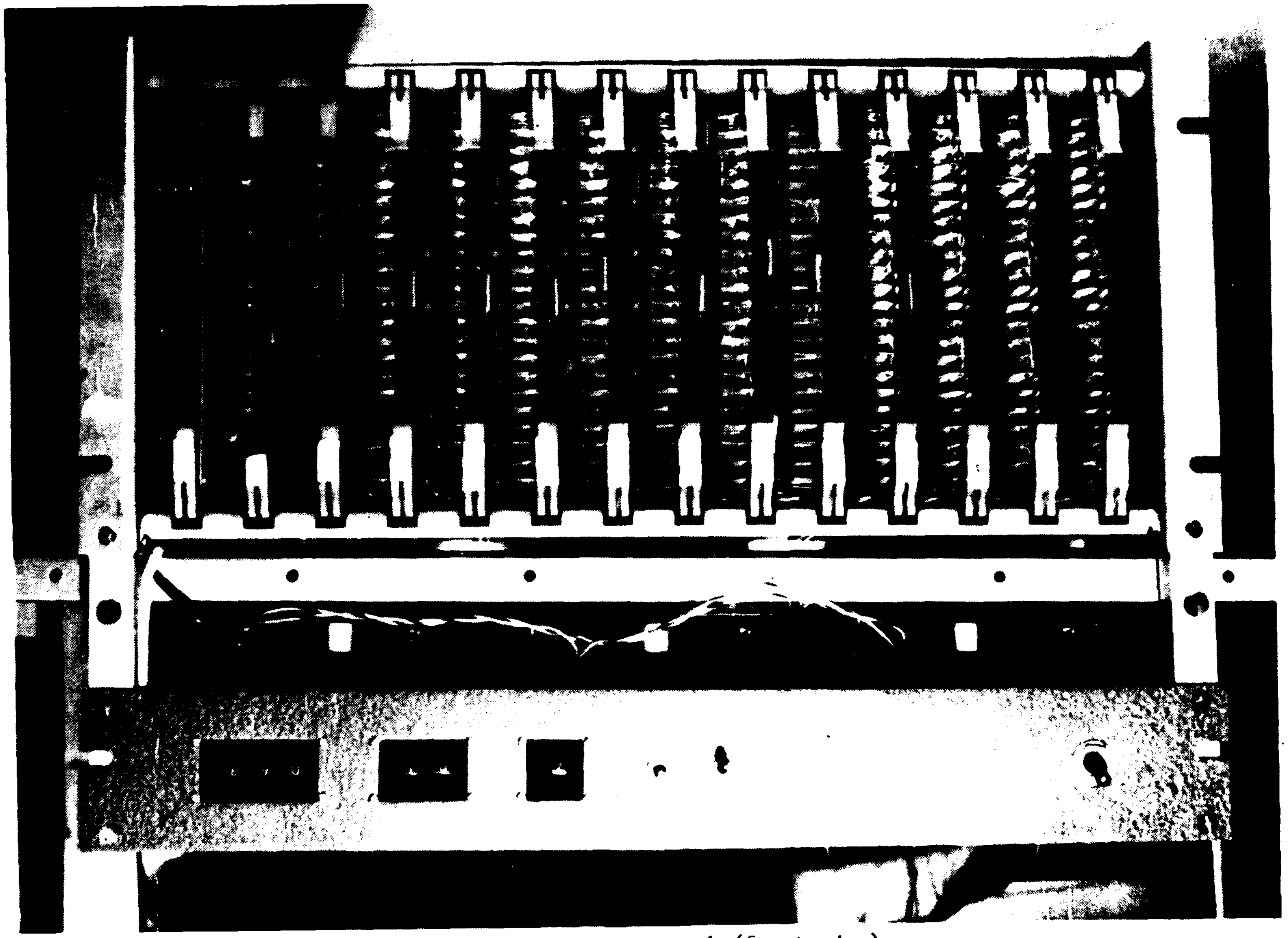


Figure 4. Electronic rack (front view).

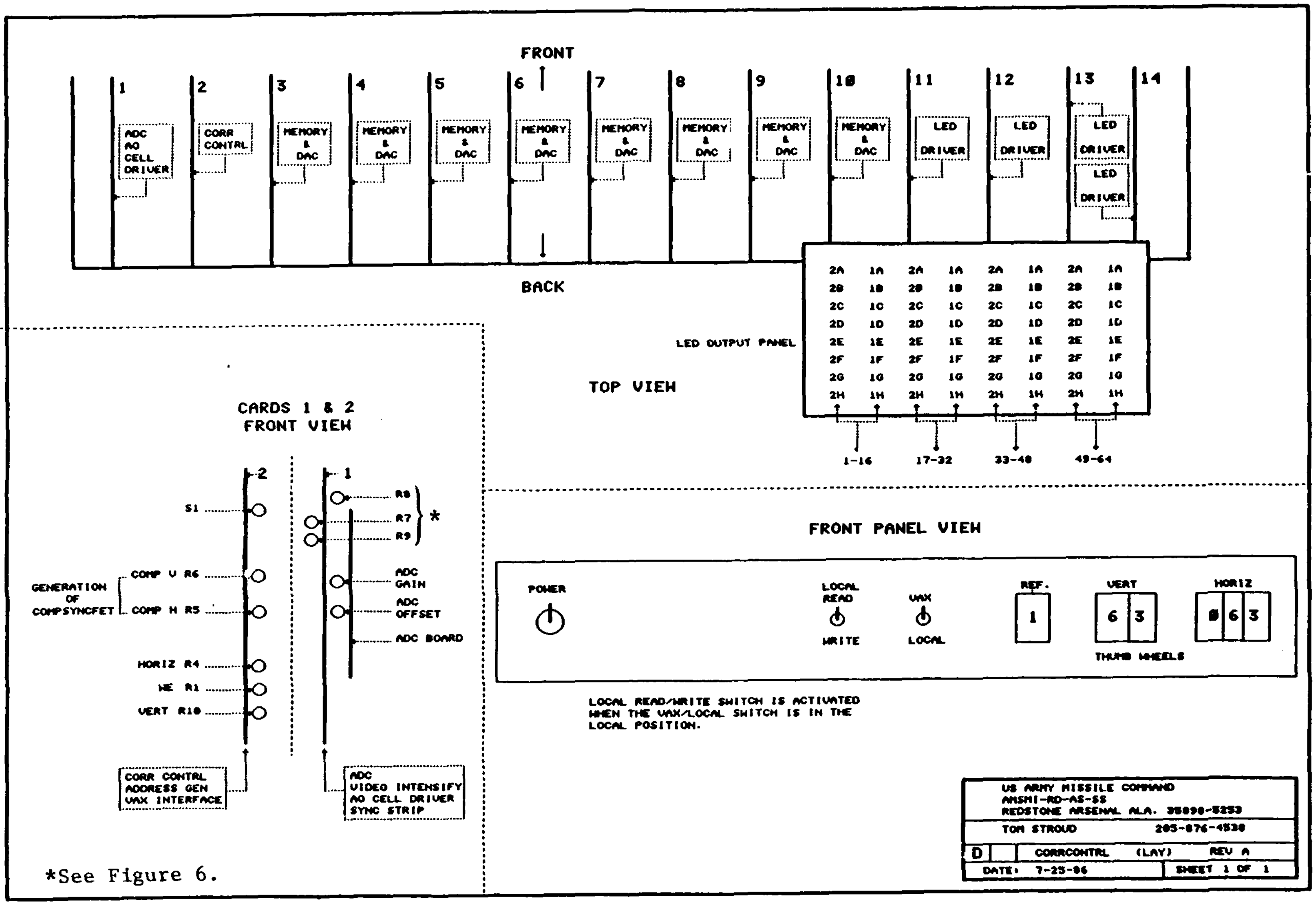


Figure 5. Electronic rack layout with front panel.

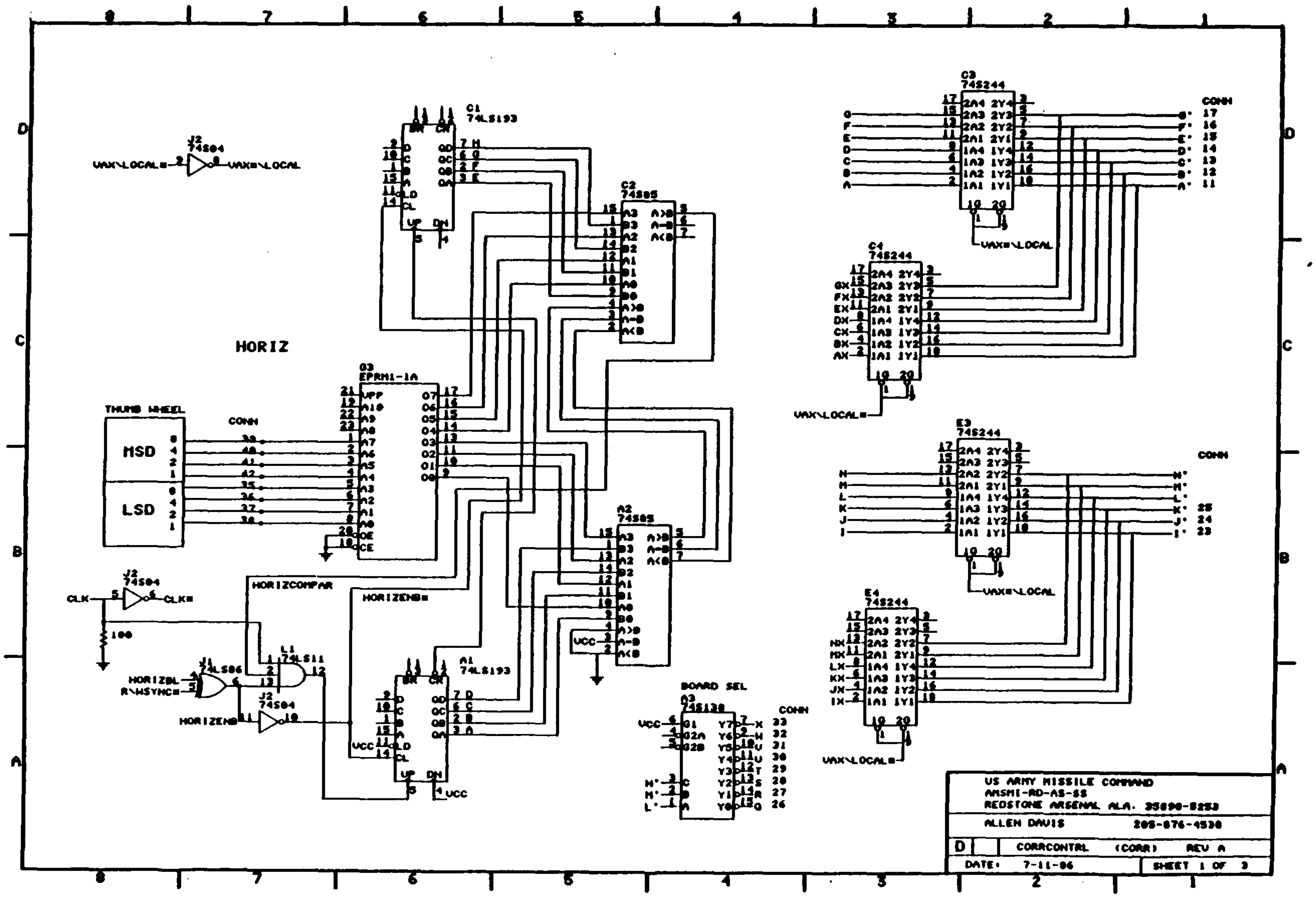


Figure 6. Digital control card (CORR).

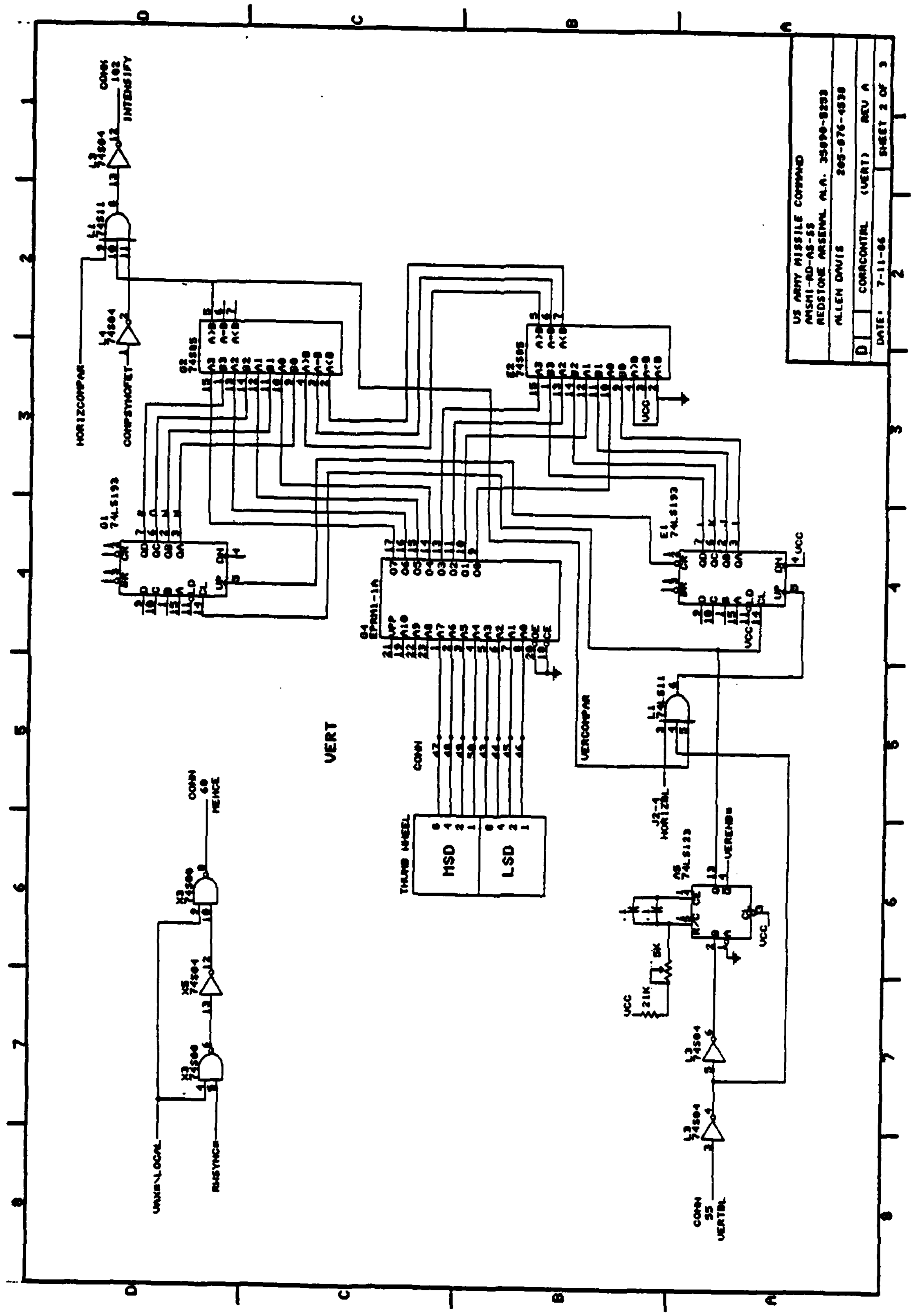


Figure 7. Digital control card (VERT).

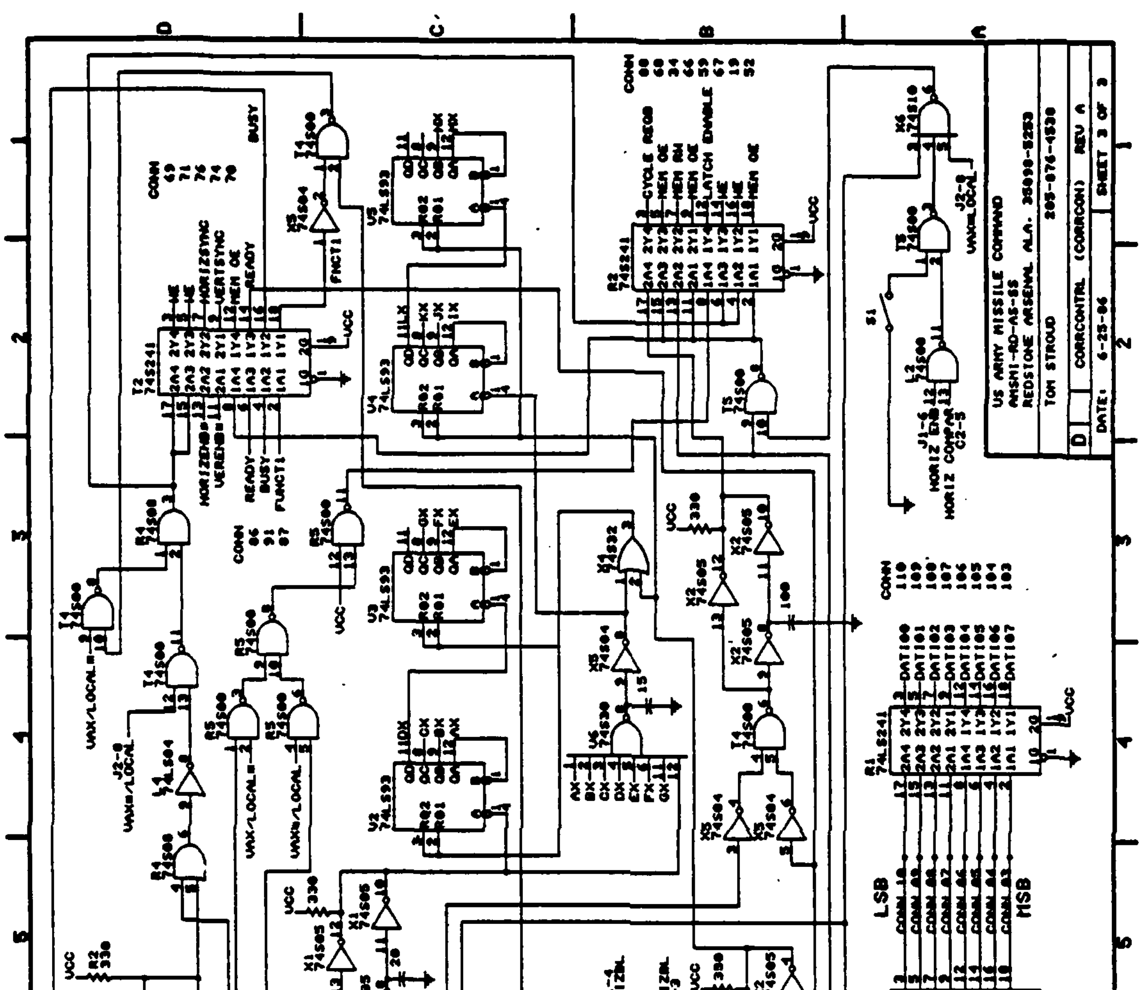


Figure 8. Digital control card (CORRCON).

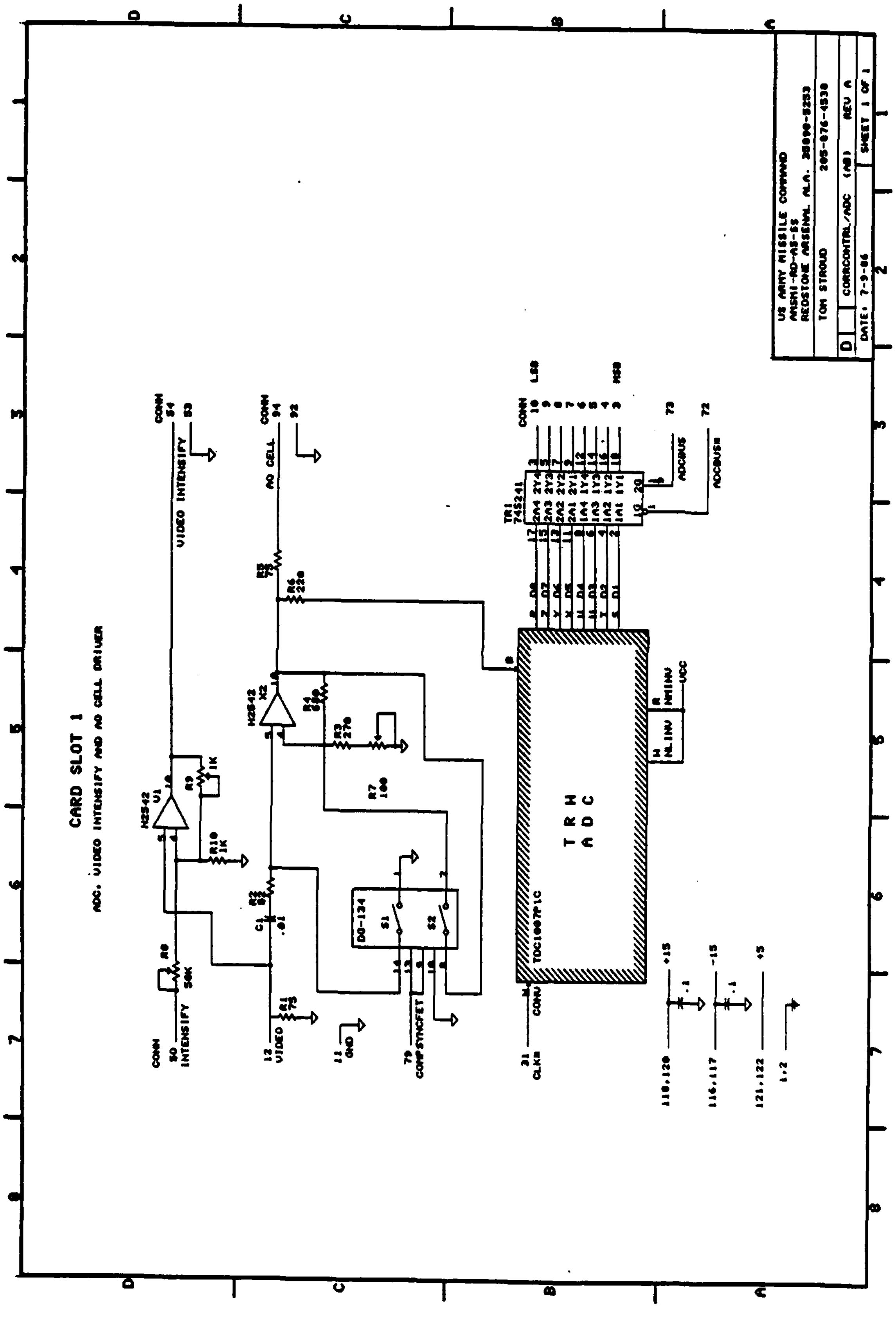
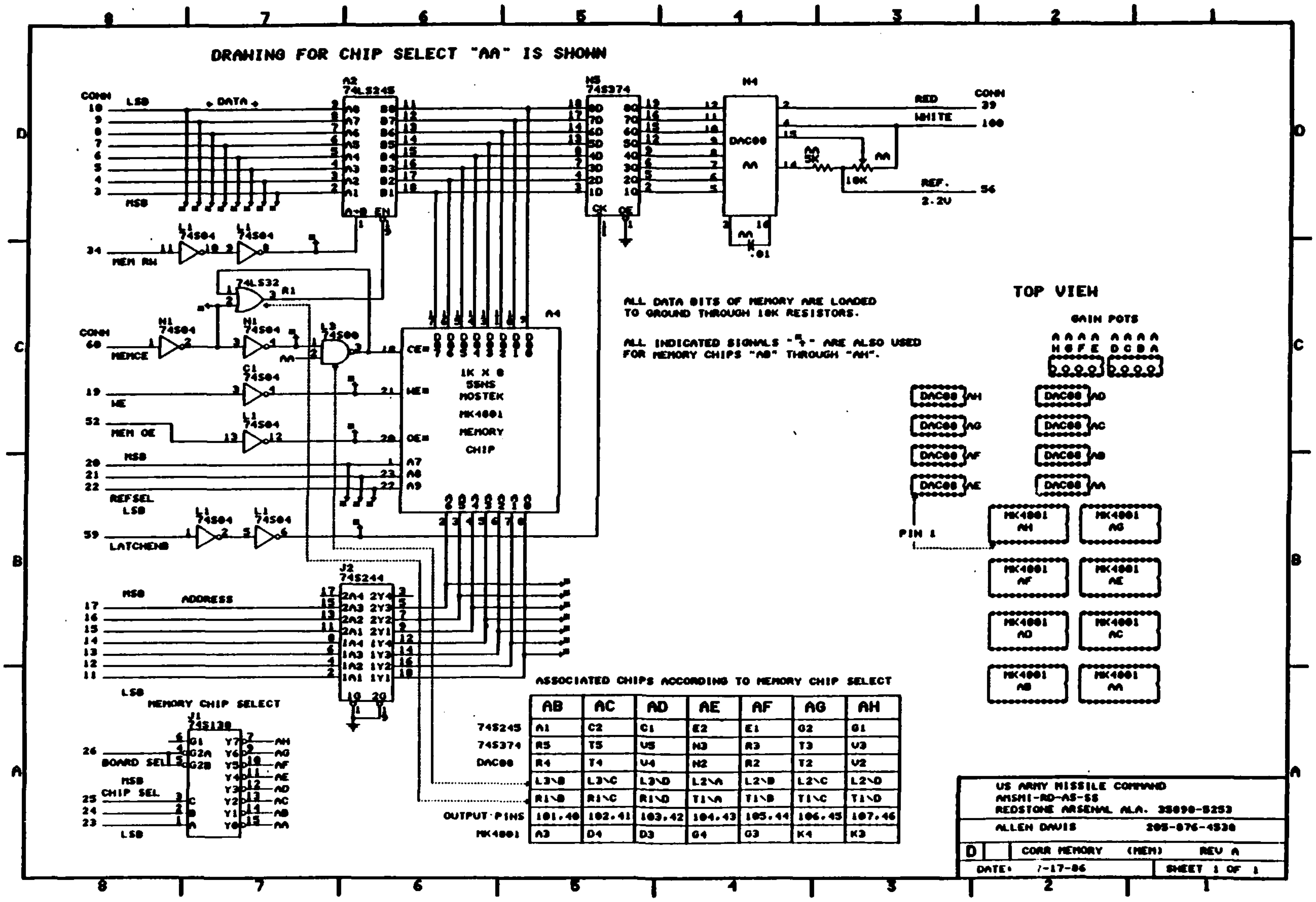


Figure 9. ADC/Video processing.



ALL DATA BITS OF MEMORY ARE LOADED TO GROUND THROUGH 10K RESISTORS.

ALL INDICATED SIGNALS "$\overset{*}{\top}$" ARE ALSO USED FOR MEMORY CHIPS "AB" THROUGH "AH".

ASSOCIATED CHIPS ACCORDING TO MEMORY CHIP SELECT

	AB	AC	AD	AE	AF	AG	AH
74S245	A1	C2	C1	E2	E1	G2	G1
74S374	R5	T5	U5	N3	R3	T3	U3
DAC08	R4	T4	U4	N2	R2	T2	U2
	L3\B	L3\C	L3\D	L2\A	L2\B	L2\C	L2\D
	R1\B	R1\C	R1\D	T1\A	T1\B	T1\C	T1\D
OUTPUT PINS	101.40	102.41	103.42	104.43	105.44	106.45	107.46
MK4001	A3	D4	D3	G4	G3	K4	K3

US ARMY MISSILE COMMAND AMSMI-RD-AS-SS REDSTONE ARSENAL ALA. 35898-5253	
ALLEN DAVIS	205-876-4530
D CORR MEMORY (MEM)	REV A
DATE: 7-17-86	SHEET 1 OF 1

Figure 10. Correlator reference memory.

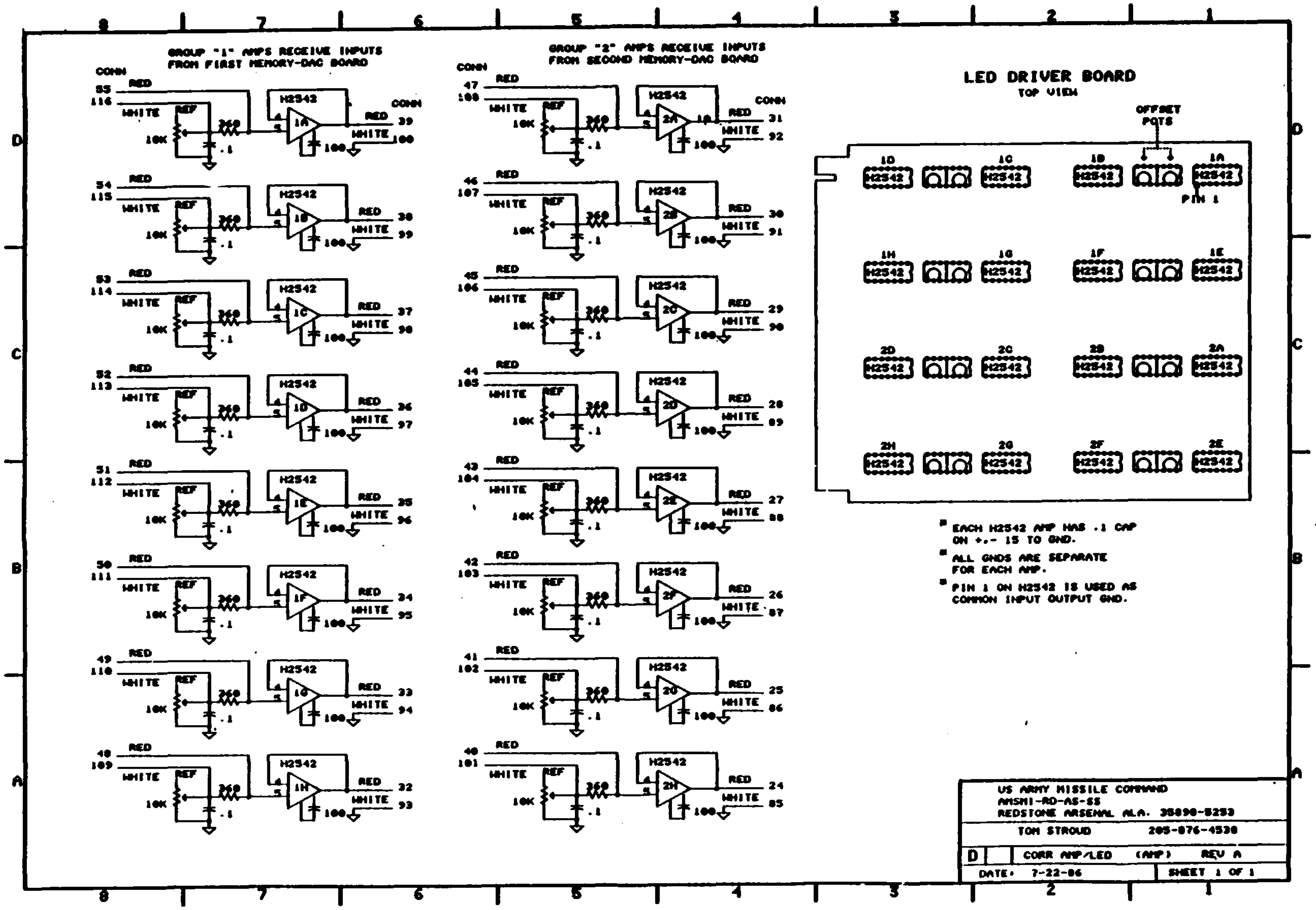

GROUP "1" AMPS RECEIVE INPUTS FROM FIRST MEMORY-DAC BOARD
GROUP "2" AMPS RECEIVE INPUTS FROM SECOND MEMORY-DAC BOARD
CONN
RED
WHITE
REF
10K
360
.1
H2542
100
LED DRIVER BOARD
TOP VIEW
OFFSET POTS
PIN 1
* EACH H2542 AMP HAS .1 CAP ON +,- 15 TO GND.
* ALL GNDS ARE SEPARATE FOR EACH AMP.
* PIN 1 ON H2542 IS USED AS COMMON INPUT OUTPUT GND.
US ARMY MISSILE COMMAND
AMSMI-RD-AS-SS
REDSTONE ARSENAL ALA. 35898-5253
TOM STROUD 205-876-4538
CORR AMP/LED (AMP) REV A
DATE: 7-22-86
SHEET 1 OF 1

Figure 11. LED driver card.

C. Output Camera Video

The output video camera is a Fairchild CCD 3000 camera with an integral thermoelectric cooler. The camera provides NTSC television video with interlaced fields, scanning 488 lines and 380 pixels per line.

The camera receives its input from the AO cell's convoluted results on a per element basis. The camera was modified by disconnecting and then grounding the photogate clock input, thereby allowing an integration in the vertical scan direction producing the complete two-dimensional correlation surface.

D. A/D Converter Module

Prior to the A/D conversion the video from the NEC camera had to be dc clamped as shown in Figure 9. The A/D converter used was the TRW TDC1007P1C providing 8 bits per sample. The sample clock was the NEC CCD camera pixel clock of approximately 7.16 megahertz.

E. Reference Memory

The reference memory is configured into 64 1024 by 8 bit memories. Each 64 by 128 is selectable through a thumbwheel switch on the front panel. Eight separate references can be stored.

Memory Operation

In reference store mode the memory selected by the thumbwheel switch is enabled and stores the incoming digitized video pixels serially. The size of the input reference is dependant on two sets of thumb-wheel switches on the front panel. The maximum size of the reference is 64 lines and 73 pixels. The vertical dimension is limited by the number of LEDs and memory in that axis. The horizontal dimension is limited by the pixel clock from the NEC camera which can clock this finite number of pixels as a maximum during the horizontal blanking time. The reference can be smaller as desired by the operator. An enhanced area on the TV monitor shows the video area being used as the reference when storing into memory. In operational mode the selected reference memory is readout in parallel. All reference lines are readout simultaneously during every horizontal blanking interval.

F. Digital to Analog Driver (D/A), LED, Fiber Optics

Each memory chip is connected to a light emitting diode (LED) via a D/A converter buffered by a high bandwidth driver. The LED is bonded to a fiber optic filament. The 64 fiber optic filament ends are placed in a linear fixture aligned vertically.

III. GENERAL DESCRIPTION AND OPERATION

The lower right of Figure 5 shows the front panel with controls:

a. VAX (Host)/LOCAL switch

o VAX - When in VAX mode the user can upload the reference memory to the host for display or storage, etc. The memory can also be downloaded for testing previously stored images or to test matched spatial filters.

o LOCAL - When in LOCAL mode the system is either storing a reference image or correlating the selected reference with the input video. The LOCAL mode is referred to in the text as the operational mode.

b. LOCAL READ/WRITE switch is activated ONLY when the VAX/LOCAL switch is in the LOCAL position.

o LOCAL READ - In this position the selected reference memory is being read for correlation.

o LOCAL WRITE - In this position the selected reference memory is being written with the upper left-hand subimage of the input video. The area being stored is enhanced on the display.

c. REF - A thumbwheel switch to select the reference memory to use.

d. VERT - A set of thumbwheel switches to select the size of the reference image up to 64 lines. These switches should be set from 0 to 63.

e. HORIZ - A set of thumbwheel switches to select the size of the reference image up to approximately 73. This setting is defined by the clock reference divided into the horizontal blanking time as a maximum.

The upper part of Figure 5 shows the board layout in the electronic rack. The LEDs are inserted in the "LED OUTPUT PANEL" on the back of the rack as shown.

IV. ALIGNMENT OF LED GAIN AND BIAS

The setting of the dynamic range of the light emitting diodes is critical to the overall correlation performance. Each LED has its own characteristics which requires an individual gain bias setting. The following steps are required:

a. Prior to removing or inserting any of the boards the power should be turned off and the correct orientation of the board in the rack must be observed.

b. Each driver board should be put on an extender one at a time, leaving the other driver boards pulled out of the rack. There are 16 LED drivers per driver board. Figure 4 shows the driver boards in slots 11 through 14.

c. Two individual memory boards are used per selected driver board, therefore one of these must be put on the extender at a time. Figure 5 shows the memory boards in slots 3 through 10. Memory boards 3 and 4 are used with driver boards in slots 3 through 10. Memory boards 3 and 4 are used with driver board 11, memory boards 5 and 6 are used with driver board 12, memory boards 7 and 8 are used with driver board 12, and memory boards 9 and 10 are used with driver board 14.

d. The front panel LOCAL READ/WRITE switch should be set to READ.

e. The VAX/LOCAL switch should be set to VAX.

f. The SELDAT routine is used to load the memory with a constant of all bits high 377 octal. (Appendix A.)

g. The VAX/LOCAL switch is now switched to LOCAL.

h. Each LED driver output is examined to determine the voltage range across the LED. The GAIN potentiometer on the memory board and the bias potentiometer on the driver board are adjusted first to ensure that the voltage swing is always positive.

i. The GAIN potentiometer can then be set to allow about a 300 millivolts pulse swing. The BIAS can then be set to where the light is just turned off on the LED output. This defines the turnoff bias point for the diode.

j. The GAIN and BIAS are then set such that the LED output is a known constant brightness determined by the CCD camera video scan, and the turnoff level is set to the now known turnoff bias.

k. In order to adjust adjacent LEDs the bias can be brought down until all diodes are adjusted then brought backup to the known turnoff bias point for operation.

l. All the above steps are repeated until each LED alined.

V. OPTICAL LAYOUT AND SPECS

The optical system consists of two spherical and three cylindrical lenses as shown in Figure 12. The focal lengths of these five lenses are required to yield the relations. It accounts for interlace effects as discussed in reference [3].

$$\frac{7.68}{2..304} = \frac{10}{3} = \frac{f_1 f_3}{f_2 f_4}$$

and

$$\frac{f_5}{f_3} \text{ between } 0.294 \text{ and } 0.356.$$

Also, the total length of the optical train must be less than 48 in., the minimum element spacing must allow room for the optical mounting fixtures and varies from 60 millimeter (mm) for f_2 and f_5 to 100 mm for the others, and provision for adjustment must be included in the mounts.

VI. CONCLUSION

Discussion of Optical Effects, System Performance, and Laboratory Results

The incoherent correlator operates on optical intensity rather than amplitude, and thus all of the image processing is performed with positive real signals. This causes an unavoidable background signal bias level to be present, and this is a fundamental property of all incoherent optical processors. The actual correlation signal thus rides on a strong background signal which is a function of scene brightness, and the structure of the numerous cross-correlations of the reference target image, and other nontarget images present in the input scene. The experimental results showed that the highly structured cross-correlations were much stronger than the desired target correlation because the input scene was several times larger than the reference image, and had at least as much dynamic intensity range and structural scene elements. This severely degraded the ability of the incoherent correlator to discriminate the target from the nontarget scene elements.

Another major problem was the overall spacial resolution capability of the correlator. The finest detail that it could successfully process was on the order of ten pixels, and thus it was an extremely low spacial bandpass system. While the basic dynamic function of correlation was achieved, the low spacial bandpass prevented the system from being able to take advantage of the high spacial frequency content, and the observed correlations were extremely low, broad, and barely visible against the high bias background, and indistinguishable from the unwanted cross-correlations. The reason for this loss of spacial detail is that all acoustooptic optical systems have much poorer imaging properties than ordinary systems and coherent optical systems. The requirements are extremely severe for such optical systems to achieve even modest image quality. Since the incoherent correlator requires exact reimaging at the output CCD plane, but with markedly different scales

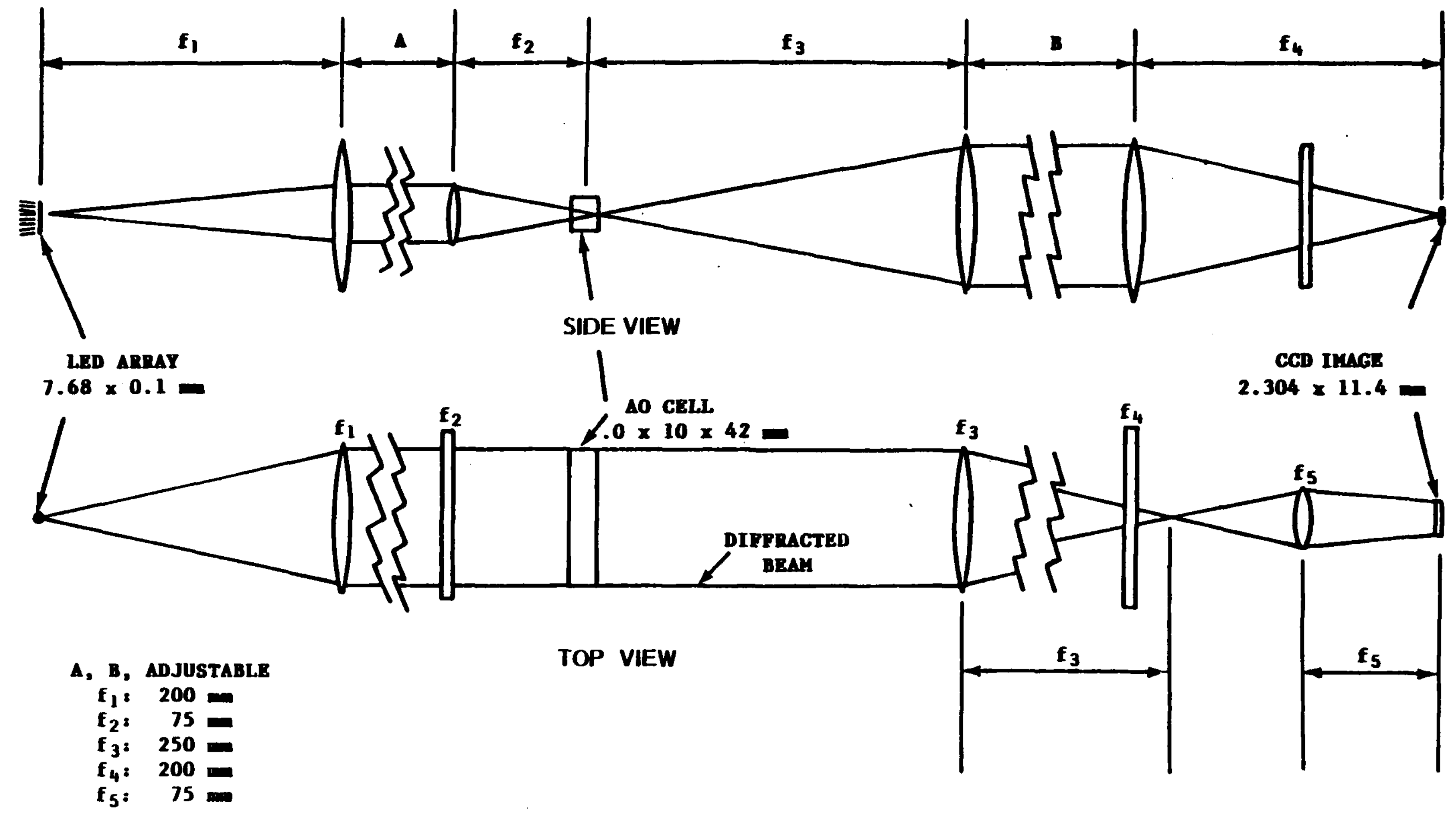


Figure 12. Incoherent correlator optics.

horizontally and vertically, it was not possible to achieve high spacial frequency transfer with the commercially available anamonphic optical lenses. The lenses required to meet this stringent image quality would have to be fully corrected, diffraction-limited, custom built optics, and their cost at the current time was far beyond the scope of this project.

One of the major objectives of the project was to determine the practicality of the optical system, and this result of image quality degradation showed that, while the acoustooptic incoherent correlator could be built and that the components could be attained with state-of-the-art techniques, it was not a cost-effective design in practical terms.

The results of the electronic design implemented is shown in Figures 13, 14, and 15. These signals produced the limits of the reference data spatial frequencies. The output was produced using a photodiode "looking" into the LED array. Several optimization ideas which would improve electronic performance were discussed, but in view of the previous discussion on the optical performance, were not implemented.

In addition, unpublished communications concerning two other research projects to build the same Psaltis architecture were received after this MICOM project was completed. Both of these projects, (Sandia National Laboratories and General Dynamics), reported unsuccessful results and indicated that their AO cells, which were identical to those used in the MICOM project, were at least partially at fault. Other problems were implied (an effort is being made to obtain further information) with this architecture. In view of the fact that three independent research projects, unknown to each other at the time, all obtained the same unsuccessful results when the original Psaltis architecture was implemented in hardware. It is concluded that this approach to a real time incoherent correlator with an undatable reference image, is unfeasible in practice. We recommend no further research on this particular architecture, and instead that other approaches be investigated.

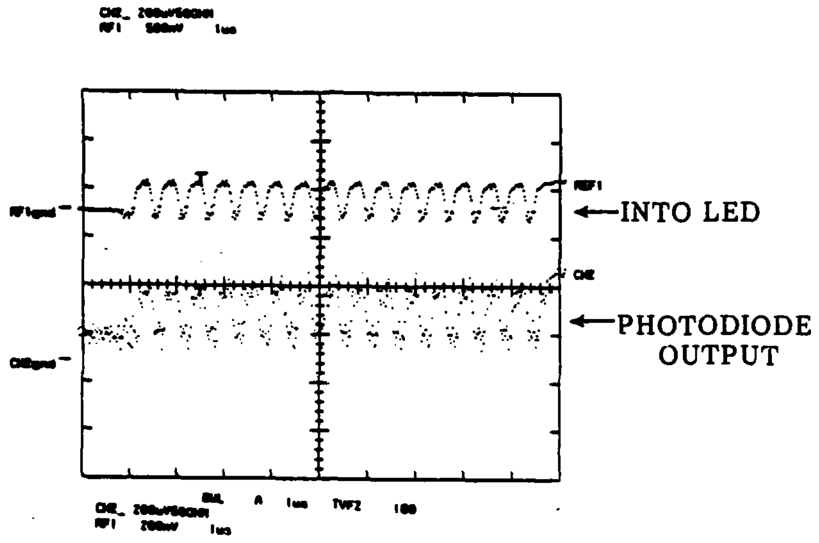


Figure 13. Half frequency test.

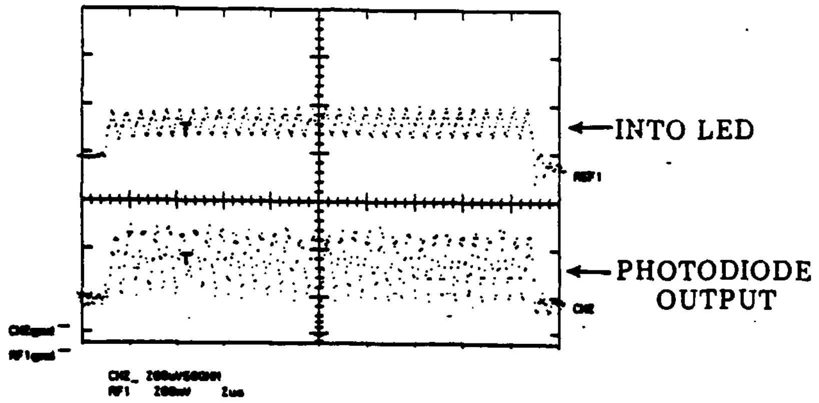


Figure 14. Maximum frequency test.

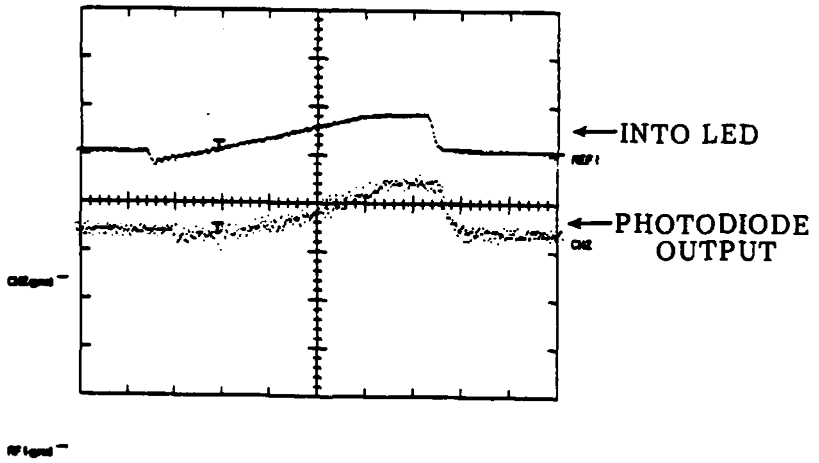


Figure 15. Ramp test 0-255.

REFERENCES

1. Psaltis, D., Opt. Eng., Vol 23, No. 1, January 1984, p. 12.

2. Psaltis, D., Proc. IEEE, Vol 72, No. 7, July 1984, p. 962.

3. Johnson, J. L., Technical Report RD-RE-86-3, U.S. Army Missile Command, Redstone Arsenal, AL, August 1986.

APPENDIX A

BAR.FOR

APPENDIX A

BAR.FOR

```
C**********************************************************************
*
C
C       THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
C       ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
C       A NEGATIVE NUMBER.
C
C**********************************************************************
*
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        BYTE DAC(64)
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
        nbytes=2*nwords
        N=1
C155    TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
C       READ(5,33)DAC(N)
33      FORMAT(I2)
        DAC(N)=31
C       IF(DAC(N).GT.0)THEN
C       N=N+1
C       GO TO 155
C       ENDIF
C       N=N-1
                DO J=1,nwords
                BUF(J)='0'O
                ENDDO
        I=1
C       DO I=1,N
        TYPE *,'DAC NUMBER=',DAC(I)
C               DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
C               BUF(K)='100'O
C               ENDDO
C       ENDDO
C               DO K=1+((DAC(I)-1)*128),((128+((DAC(I)-1)*128))/2)-1
C               BUF(K)=0
C   C           ENDDO
C               DO K=((128+((DAC(I)-1)*128))/2)-1,128+((DAC(I)-1)*128)
C               BUF(K)=0
C               ENDDO
```

BAR.FOR

```
        DO I=31,8192-95,128
        BUF(I)='377'O
        ENDDO
C       BUF(4000-128)='377'O

        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
 1111   ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
        1IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
        END
```

APPENDIX B

BAR2.FOR

APPENDIX B

BAR2.FOR

```
C************************************************************************
*
C
C      THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
C      ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
C      A NEGATIVE NUMBER.
C
C************************************************************************
*
       EXTERNAL IO$WRITEVBLK,IO$READVBLK
       INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
       INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
       BYTE DAC(64)
       CHARACTER*80 MSGBUF
         DATA ITIMES/0/
       ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
       IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
       NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
       nbytes=2*nwords
       N=1
C155    TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
C      READ(5,33)DAC(N)
33     FORMAT(I2)
       DAC(N)=31
C      IF(DAC(N).GT.0)THEN
C      N=N+1
C      GO TO 155
C      ENDIF
C      N=N-1
               DO J=1,nwords
               BUF(J)='0'O
               ENDDO
       I=1
C      DO I=1,N
       TYPE *,'DAC NUMBER=',DAC(I)
C              DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
C              BUF(K)='100'O
C              ENDDO
C      ENDDO
C              DO K=1+((DAC(I)-1)*128),((128+((DAC(I)-1)*128))/2)-1
C              BUF(K)=0
C  C           ENDDO
C              DO K=((128+((DAC(I)-1)*128))/2)-1,128+((DAC(I)-1)*128)
C              BUF(K)=0
C              ENDDO
```

BAR2.FOR

```
      DO I=31,8192-95,128
      BUF(I)='377'O
      BUF(I+1)='377'O
      ENDDO
C     BUF(4000-128)='377'O

      ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
     1BUF(1),%VAL(NBYTES),,,,)
      IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
      ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'QIO PARAMETER STATUS:',MSGBUF
      MSGBUF=' '
      ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'I/O STATUS:',MSGBUF
      IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
      IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
      ENDIF
1111  ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
     1IOSB,,,
     1RBUF(1),%VAL(NBYTES),,,,)
      END
```

APPENDIX C

CDACTEST.FOR

APPENDIX C

CDACTEST.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
c1      do 100 itest=1,5
1       continue
                DO J=1,nwords
                buf(j)=(j-1)*2
c               if(itest.eq.1)BUF(J)=J
c               if(itest.eq.2)buf(j)=0
c               if(itest.eq.3)buf(j)='377'o
c               if(itest.eq.4)buf(j)='125'o
c               if(itest.eq.5)buf(j)='052'o
                ENDDO
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
1111    ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
        1IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
C         DO I=1,NWORDS
C         IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
C         WRITE(6,11)I,IAND(BUF(I),'377'O),IAND(RBUF(I),'377'O)
11      FORMAT('** MEMORY R/W ERROR AT',O6,'  INPUT=',1X,O6,
        1'     OUTPUT=',O6)
```

CDACTEST.FOR

```
 C        ENDIF
 C        ENDDO

 100     continue
           ITIMES=ITIMES+1
 C         type *,'memory test complete with the above errors.',ITIMES,
 C       1' ON',NWORDS, ' LOCATIONS'
         GO TO 1111
         END
```

APPENDIX D

CFREQTEST.FOR

APPENDIX D

CFEQTEST.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
c1      do 100 itest=1,5
1       continue
                DO J=2,nwords,2
                BUF(J-1)='377'O
                BUF(J)=0
C               buf(j)=(j-1)*2
c               if(itest.eq.1)BUF(J)=J
c               if(itest.eq.2)buf(j)=0
c               if(itest.eq.3)buf(j)='377'o
c               if(itest.eq.4)buf(j)='125'o
c               if(itest.eq.5)buf(j)='052'o
                ENDDO
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
1111    ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
        1IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
C         DO I=1,NWORDS
C         IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
C         WRITE(6,11)I,IAND(BUF(I),'377'O),IAND(RBUF(I),'377'O)
```

CFREQTEST.FOR

```
 11      FORMAT('** MEMORY R/W ERROR AT',O6,'  INPUT=',1X,O6,
         1'     OUTPUT=',O6)
 C         ENDIF
 C         ENDDO

 100     continue
           ITIMES=ITIMES+1
 C         type *,'memory test complete with the above errors.',ITIMES,
 C       1' ON',NWORDS, ' LOCATIONS'
         GO TO 1111
         END
```

APPENDIX E

CMEMDUMP.FOR

APPENDIX E

CMEMDUMP.FOR

```
      EXTERNAL IO$WRITEVBLK,IO$READVBLK
      INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
      INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
      CHARACTER*80 MSGBUF
        DATA ITIMES/0/
      ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
      IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
      TYPE *,'ENTER NUMBER OF LOCATIONS TO DUMP'
      ACCEPT*,NWORDS
      NBYTES=NWORDS*2
1111  ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
      1IOSB,,,
      1RBUF(1),%VAL(NBYTES),,,,)
        DO I=1,NWORDS
C       IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
      IF(IAND(RBUF(I),'377'O).NE.0)THEN
        WRITE(6,11)I,IAND(RBUF(I),'377'O)
11    FORMAT('** MEMORY AT',O6,
      1' =',O6)
C       ENDIF
      ENDIF
        ENDDO

100   continue
      END
```

APPENDIX F

CMEMTEST.FOR

APPENDIX F

CMEMTEST.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
          INTEGER*2 ERROR,ITIMES,NWORDS
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/,ERROR/0./
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
1       do 100 itest=1,5
                DO J=1,nwords
                if(itest.eq.1)BUF(J)=J
                if(itest.eq.2)buf(j)=0
                if(itest.eq.3)buf(j)='377'o
                if(itest.eq.4)buf(j)='125'o
                if(itest.eq.5)buf(j)='052'o
                ENDDO
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO WRITE PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO READ PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
```

CMEMTEST.FOR

```
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
          DO I=1,NWORDS
          IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
          ERROR=ERROR+1.
C         WRITE(6,11)I,IAND(BUF(I),'377'O),IAND(RBUF(I),'377'O)
11      FORMAT('** MEMORY R/W ERROR AT ',I4,'  INPUT=',1X,O6,
        1'     OUTPUT=',O6)
          LOW=IAND(I,'177'O)
          ICHIP=ISHFT(IAND(I,'1600'O),-7)+1
          IBOARD=ISHFT(IAND(I,'16000'O),-10)+1
          IF(ICHIP.NE.IOLDCHIP)
        1 TYPE *,'BOARD,CHIP,=',IBOARD,ICHIP
          IOLDBOARD=IBOARD
          IOLDCHIP=ICHIP
          ENDIF
          ENDDO

100     continue
          ITIMES=ITIMES+1
          type *,'memory tested with the above',ERROR,
        1' errors.',ITIMES,
        1' ON',NWORDS, ' LOCATIONS'
        GO TO 1
        END
```

APPENDIX G

CREADI

APPENDIX G

CREADI

```
      EXTERNAL IO$WRITEVBLK,IO$READVBLK
      INTEGER*2 RBUF(8192),BUF(8192),IOSB(4),IMAGE(128,64)
        INTEGER*2 IXBW,IYBW
      INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
      CHARACTER*80 MSGBUF
        EQUIVALENCE (BUF,IMAGE)
      COMMON/BALLO/IXBW,IYBW
      COMMON/CHAN/ITCHAN,IGCHAN
        DATA ITIMES/0/
        DATA IXBW/0/,IYBW/400/
      ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
      IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
      ISTATUS=SYS$ASSIGN('GRA0',IGCHAN,,)
      IF(.NOT.ISTATUS)TYPE *,'ERROR IN GRINNELL CHANNEL ASSIGN'
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCCC
C       DO I=1,64
C       DO J=1,128
C       IMAGE(J,I)=IAND(I*J,'377'O)
C       ENDDO
C       ENDDO
C
C       DO J=1,128
C       IMAGE(J,1)='377'O
C       IMAGE(J,64)='377'O
C       ENDDO
C
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
      ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
      1BUF(1),%VAL(16384),,,,)
      IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
      ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'QIO PARAMETER STATUS:',MSGBUF
      MSGBUF=' '
      ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'I/O STATUS:',MSGBUF
      IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
      IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
```

```
        ENDIF
 C        WRITE(6,111)IMAGE
 111    FORMAT(1X,10(1X,O6))
          DO I=1,64
          DO J=1,127
          IMAGE(J,I)=IAND(IMAGE(J,I),'377'O)
          ENDDO
          IMAGE(128,I)='34015'O
          ENDDO
          CALL PIX(IMAGE)
        END
        SUBROUTINE PIX(IBUFA)
        IMPLICIT INTEGER*2 (A-Z)
        EXTERNAL IO$WRITEVBLK
        INTEGER SYS$QIOW,ITCHAN,IGCHAN,J,IO$WRITEVBLK
        INTEGER*2 OUT(12),IBUFA(1)
        COMMON/CHAN/ITCHAN,IGCHAN
        COMMON/BALLO/IXBW,IYBW
        DATA OUT/'17777'O,'120000'O,'107777'O,'24055'O,'26002'O,'44000'O,
        1'50002'O,'54000'O,'64000'O,'74776'O,0,0/
        OUT(11)=IXBW.OR.'44000'O
        OUT(12)=IYBW.OR.'64000'O
        J=SYS$QIOW(%VAL(1),%VAL(IGCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1OUT(1),%VAL(24),,,,)
        J=SYS$QIOW(%VAL(1),%VAL(IGCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1IBUFA(1),%VAL(16384),,,,)
        RETURN
        END
```

APPENDIX H

CRWIMAGE.FOR

APPENDIX H

CRWIMAGE.FOR

```
C
C       THIS ROUTINE ZEROS OUT THE LAST 128-SWITCH COLUMNS
C       AND STORES THE IMAGE BACK IN REFERENCE MEMORY
C
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4),IMAGE(128,64)
          INTEGER*2 IXBW,IYBW
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        CHARACTER*80 MSGBUF
          EQUIVALENCE (BUF,IMAGE)
        COMMON/BALLO/IXBW,IYBW
        COMMON/CHAN/ITCHAN,IGCHAN
          DATA ITIMES/0/
          DATA IXBW/0/,IYBW/400/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        ISTATUS=SYS$ASSIGN('GRA0',IGCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN GRINNELL CHANNEL ASSIGN'
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCCCC
C         DO I=1,64
C         DO J=1,128
C         IMAGE(J,I)=IAND(I*J,'377'O)
C         ENDDO
C         ENDDO
C
C         DO J=1,128
C         IMAGE(J,1)='377'O
C         IMAGE(J,64)='377'O
C         ENDDO
C
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
        1BUF(1),%VAL(16384),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
```

CRWIMAGE.FOR

```
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
        DO I=1,64
        DO J=63,127
        IMAGE(J,I)=0
        ENDDO
        ENDDO
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(16384),,,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR ON WRITE BACK'
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
        1BUF(1),%VAL(16384),,,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR ON SECOND READ'
C         WRITE(6,111)IMAGE
111     FORMAT(1X,10(1X,O6))
          DO I=1,64
          DO J=1,127
          IMAGE(J,I)=IAND(IMAGE(J,I),'377'O)
          ENDDO
          IMAGE(128,I)='34015'O
          ENDDO
          CALL PIX(IMAGE)
        END
        SUBROUTINE PIX(IBUFA)
        IMPLICIT INTEGER*2 (A-Z)
        EXTERNAL IO$WRITEVBLK
        INTEGER SYS$QIOW,ITCHAN,IGCHAN,J,IO$WRITEVBLK
        INTEGER*2 OUT(12),IBUFA(1)
        COMMON/CHAN/ITCHAN,IGCHAN
        COMMON/BALLO/IXBW,IYBW
        DATA OUT/'17777'O,'120000'O,'107777'O,'24055'O,'26002'O,'44000'O,
        1'50002'O,'54000'O,'64000'O,'74776'O,0,0/
        OUT(11)=IXBW.OR.'44000'O
        OUT(12)=IYBW.OR.'64000'O
        J=SYS$QIOW(%VAL(1),%VAL(IGCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1OUT(1),%VAL(24),,,,)
        J=SYS$QIOW(%VAL(1),%VAL(IGCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1IBUFA(1),%VAL(16384),,,,)
        RETURN
        END
```

APPENDIX I

DELTA.FOR

APPENDIX I

DELTA.FOR

```
C***************************************************************************
*
C
C       THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
C       ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
C       A NEGATIVE NUMBER.
C
C***************************************************************************
*
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        BYTE DAC(64)
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
        nbytes=2*nwords
        N=1
C155    TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
C       READ(5,33)DAC(N)
33      FORMAT(I2)
        DAC(N)=31
C       IF(DAC(N).GT.0)THEN
C       N=N+1
C       GO TO 155
C       ENDIF
C       N=N-1
                DO J=1,nwords
                BUF(J)='0'O
                ENDDO
        I=1
C       DO I=1,N
        TYPE *,'DAC NUMBER=',DAC(I)
                DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
                BUF(K)='377'O
                ENDDO
C       ENDDO
                DO K=1+((DAC(I)-1)*128),((128+((DAC(I)-1)*128))/2)-1
                BUF(K)=0
                ENDDO
                DO K=((128+((DAC(I)-1)*128))/2)-1,128+((DAC(I)-1)*128)
                BUF(K)=0
                ENDDO
```

DELTA.FOR

```
      BUF(4000-128)='377'O

      ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
      1BUF(1),%VAL(NBYTES),,,,)
      IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
      ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'QIO PARAMETER STATUS:',MSGBUF
      MSGBUF=' '
      ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'I/O STATUS:',MSGBUF
      IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
      IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
      ENDIF
 1111 ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
      1IOSB,,,
      1RBUF(1),%VAL(NBYTES),,,,)
      END
```

APPENDIX J

DELTA2.FOR

APPENDIX J

DELTA2.FOR

```
C***********************************************************************************
*
C
C      THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
C      ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
C      A NEGATIVE NUMBER.
C
C***********************************************************************************
*
       EXTERNAL IO$WRITEVBLK,IO$READVBLK
       INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
       INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
       BYTE DAC(64)
       CHARACTER*80 MSGBUF
         DATA ITIMES/0/
       ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
       IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
       NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
       nbytes=2*nwords
       N=1
C155    TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
C      READ(5,33)DAC(N)
33     FORMAT(I2)
       DAC(N)=31
C      IF(DAC(N).GT.0)THEN
C      N=N+1
C      GO TO 155
C      ENDIF
C      N=N-1
               DO J=1,nwords
               BUF(J)='0'O
               ENDDO
       I=1
C      DO I=1,N
       TYPE *,'DAC NUMBER=',DAC(I)
               DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
               BUF(K)='100'O
               ENDDO
C      ENDDO
               DO K=1+((DAC(I)-1)*128),((128+((DAC(I)-1)*128))/2)-1
               BUF(K)=0
               ENDDO
               DO K=((128+((DAC(I)-1)*128))/2)-1,128+((DAC(I)-1)*128)
               BUF(K)=0
               ENDDO
```

DELTA2.FOR

```
      DO JJ=1,2
      BUF(4000-128-2+JJ)='377'O
      BUF(4000-256-2+JJ)='377'O
      BUF(4000-384-2+JJ)='377'O
      BUF(4000-512-2+JJ)='377'O
      ENDDO

      ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
     1BUF(1),%VAL(NBYTES),,,,)
      IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
      ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'QIO PARAMETER STATUS:',MSGBUF
      MSGBUF=' '
      ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'I/O STATUS:',MSGBUF
      IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
      IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
      ENDIF
1111  ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
     1IOSB,,,
     1RBUF(1),%VAL(NBYTES),,,,)
      END
```

APPENDIX K

IMAGEH.FOR

APPENDIX K

IMAGEH.FOR

```
ccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc
c       This routine reads in the selected reference image from the
c       correlator memory and generates the gray scale histogram
ccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IMGTBL.CMN'
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IOTBL.CMN'
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4),IMAGE(128,64)
          INTEGER*2 IXBW,IYBW
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        integer*2 tb(65,64)
        integer hist(256)
        CHARACTER*80 MSGBUF
          EQUIVALENCE (BUF,IMAGE)
        COMMON/BALLO/IXBW,IYBW
        COMMON/CHAN/ITCHAN
          DATA ITIMES/0/
          DATA IXBW/0/,IYBW/256/
        data ncol,nrow/64,64/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        ISTATUS=SYS$ASSIGN('GRA0',GRCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN GRINNELL CHANNEL ASSIGN'
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCC
c         DO I=1,64
c         DO J=1,128
c         IMAGE(J,I)=IAND(I*J,'377'O)
c         ENDDO
c         ENDDO
c         DO J=1,128
c         IMAGE(J,1)='377'O
c         IMAGE(J,64)='377'O
c         ENDDO
C       do i=1,64
C       do j=1,64
C       image(j,i)=iand(4*(j-1),'370'o)
C       enddo
C       enddo
C
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
        1BUF(1),%VAL(16384),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
       .ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'

        ENDIF
C         WRITE(6,111)IMAGE
111     FORMAT(1X,10(1X,O6))
cccccccccccc
c       put out the histogram to the grinnell
c
          DO I=1,64
          DO J=1,127
          IMAGE(J,I)=IAND(IMAGE(J,I),'377'O)
          ENDDO
          ENDDO

        do i=1,64
        do j=1,64
        tb(j,i)=image(j,i)
        enddo
        enddo
        CALL GGHIST(tb)
          DO I=1,64
          IMAGE(128,I)='34015'O
          ENDDO
          CALL PIX(IMAGE)
        END
        SUBROUTINE PIX(IBUFA)
        IMPLICIT INTEGER*2 (A-Z)
        EXTERNAL IO$WRITEVBLK
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IOTBL.CMN'
        INTEGER SYS$QIOW,ITCHAN,J,IO$WRITEVBLK
        INTEGER*2 OUT(12),IBUFA(1)
        COMMON/CHAN/ITCHAN
        COMMON/BALLO/IXBW,IYBW
        DATA OUT/'17777'O,'120000'O,'107777'O,'24055'O,'26002'O,'44000'O,
        1'50002'O,'54000'O,'64000'O,'74776'O,0,0/
        OUT(11)=IXBW.OR.'44000'O
        OUT(12)=IYBW.OR.'64000'O
        J=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1OUT(1),%VAL(24),,,,)
        J=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1IBUFA(1),%VAL(16384),,,,)
        RETURN
        END
        SUBROUTINE GGHIST(IMAGE)
C *************************************************************
C
```

IMAGEH.FOR

```
 C       FUNCTION:
 C
 C       THIS ROUTINE PERFORMS A HISTOGRAM ON THE IMAGE
 C
 C ****************************************************************
 C
 C       ARGUMENTS:
 C
 C
 C ****************************************************************
 C
 C       MODULE NOTES:
 C
 C
 C ****************************************************************
 C
 C
 C       MODULE CREATION DATE:
 C
 C       DEC. 1985
 C
 C *****************************************************************
 C
 C       MODULE MODIFICATION HISTORY:
 C
 C
 C *********************** EOH ***********************************
 C
 C
         EXTERNAL IO$WRITEVBLK
         INCLUDE 'DISK$USERDISK:[SUBIMAGE]IMGTBL.CMN'
         INCLUDE 'DISK$USERDISK:[SUBIMAGE]IOTBL.CMN'
         COMMON/IMGSOURCE/IMGSOURCE      !IMAGE SOURCE STRING COMMON TO SUBCON
 SUBINIT
         CHARACTER*5 IMGSOURCE
         INTEGER*4 OPRINP
         INTEGER*4 CHECKIMG              !DUPLICATE IMAGE CHECK FUNCTION
         LOGICAL*1 DISKINPUT             !DISK/TAPE INPUT FLAG .TRUE.=DISK
 .FALSE.=TAPE
         DATA DISKINPUT/.TRUE./  !ASSUME DISK INPUT
         CHARACTER*4 CHARIN              !OPERATER RESPONSE
         INTEGER*2 IACODE                !VARIABLE TO CONTAIN OPERATOR FUN REQ
         INTEGER*4 DSPUPD
         LOGICAL*1 IIFLG                 !REWRITE HEADER2 LOGICAL FLAG
         LOGICAL*1 TAPEDUP,OLDIMG/.FALSE./
         DIMENSION LISTFSIZE(3),LISTSPEED(3),LISTFPOS(3)
         DIMENSION LIST(8),ILIST(3),LISTMODE(2),LISTSPDT(2)
         DIMENSION MLIST(5)
         INTEGER*2 ERASEQ(15),IMAGE(NCOL+1,NROW),OUT(780)
         INTEGER HIST(256)
         DATA ERASEQ/'100000'O,'17777'O,'24240'O,'121040'O,
         1'140001'O,'121000'O,'110000'O,'107777'O,'121000'O,
         2'64000'O,'70377'O,'44000'O,'52377'O,'24040'O,'26000'O/
         I=LIB$ERASEPAGE(1,1)            !ERASE SCREEN
 C       IER = IFENCEY + IFENCEYSIZE - 1 !COMPUTE ENDING ROW FOR SUB IMAGE
 C       IEC = IFENCEX + IFENCEXSIZE - 1 !COMPUTE ENDING COL FOR SUBIMAGE
         IER=64
         IEC=64
```

IMAGEH.FOR

```
C       CALL MESSAGE('ENTER HISTOGRAM PLOT QUADRANT')
C       CALL ACCEPT(IACODE)               !GET THE OPERATORS REQ KEY
C       IF(IACODE.EQ.'0031'X)THEN
        ERASEQ(10)='64400'O      !LLA
        ERASEQ(12)='44377'O      !LEA
C       ENDIF
C       IF(IACODE.EQ.'0032'X)THEN
C       ERASEQ(10)='64400'O
C       ERASEQ(12)='44000'O
C       ENDIF
C       IF(IACODE.EQ.'0033'X)THEN
C       ERASEQ(10)='64000'O
C       ERASEQ(12)='44000'O
C       ENDIF
C       IF(IACODE.EQ.'0034'X)THEN
C       ERASEQ(10)='64000'O
C       ERASEQ(12)='44400'O
C       ENDIF
        I=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1ERASEQ,%VAL(30),,,,)
        IFENCEY=1
        IFENCEX=1
        DO ICOL=1,256
                HIST(ICOL)=0
        ENDDO
        DO IROW=IFENCEY,IER
        DO ICOL=IFENCEX,IEC
C               PRINT *,'IMAGE(ICOL,IROW)=',IMAGE(ICOL,IROW),ICOL,IROW
        IF(IMAGE(ICOL,IROW)+1 .GT. 256 .OR. IMAGE(ICOL,IROW)+1 .LT.1)
        1TYPE *,'DATA ERROR IN INPUT IMAGE !!!!!!!!!!!',IMAGE(ICOL,IROW)+1
                HIST(IMAGE(ICOL,IROW)+1)=HIST(IMAGE(ICOL,IROW)+1)+1
        ENDDO
        ENDDO
        LMAX=-1000000
        LMIN=1000000
C       SKIP ZERO WHEN GETTING SCALE FOR HISTOGRAM (START AT 2)
        MAXLOCATION=0
        MINLOCATION=0
        DO ILOOK=2,256
                IF(HIST(ILOOK).GT.LMAX) THEN
                LMAX=HIST(ILOOK)
                MAXLOCATION=ILOOK
                ENDIF
                IF(HIST(ILOOK).LT.LMIN) THEN
                LMIN=HIST(ILOOK)
                MINLOCATION=ILOOK
                ENDIF
        ENDDO
                IF(LMAX.EQ.LMIN)THEN
        TYPE *,'MAX IS THE SAME AS MIN.....!!!!!!!=',LMAX
        RETURN
        ELSE
        TYPE*,'MAX,MIN=',LMAX,LMIN
        TYPE *,'MAXLOCATION=',MAXLOCATION
        TYPE *,'MINLOCATION=',MINLOCATION
                ENDIF
c       HIST(1)=(HIST(1)-LMIN)/(LMAX-LMIN)
        IF(HIST(1).GT.255)HIST(1)=255   !THIS TAKES CARE OF ZERO
        DO ILOOK=2,256
        HIST(ILOOK)=255.*(FLOAT(HIST(ILOOK))-FLOAT(LMIN))/
        1(FLOAT(LMAX)-FLOAT(LMIN))
        ENDDO
C         TYPE *,HIST
444     IOUT=2
        OUT(1)='50000'O
        DO ILOAD=1,256
        OUT(IOUT)=ERASEQ(12)+(ILOAD)
        OUT(IOUT+1)=ERASEQ(10)
        OUT(IOUT+2)='72000'O+HIST(ILOAD)
        IOUT=IOUT+3
        ENDDO
        IOUT=IOUT-1
        I=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1OUT,%VAL(IOUT*2),,,,)
        RETURN
        END
```

APPENDIX L

IMAGEHDEMO.FOR

APPENDIX L

IMAGEHDEMO.FOR

```
cccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc
c       This routine reads in the selected reference image from the
c       correlator memory and generates the gray scale histogram
cccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IMGTBL.CMN'
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IOTBL.CMN'
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4),IMAGE(128,64)
          INTEGER*2 IXBW,IYBW
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        integer hist(256)
        CHARACTER*80 MSGBUF
          EQUIVALENCE (BUF,IMAGE)
        COMMON/BALLO/IXBW,IYBW
        COMMON/CHAN/ITCHAN
          DATA ITIMES/0/
          DATA IXBW/0/,IYBW/256/
        data ncol,nrow/64,64/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        ISTATUS=SYS$ASSIGN('GRA0',GRCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN GRINNELL CHANNEL ASSIGN'
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCC
C         DO I=1,64
C         DO J=1,128
C         IMAGE(J,I)=IAND(I*J,'377'O)
C         ENDDO
C         ENDDO
C
C         DO J=1,128
C         IMAGE(J,1)='377'O
C         IMAGE(J,64)='377'O
C         ENDDO
        do i=1,64
        do j=1,64
        image(j,i)=IAND(I*J,'377'O)
        enddo
        enddo
C
C
C
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCTEST IMAGECCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
C       ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
C       1BUF(1),%VAL(16384),,,,)
C       IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
C       ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
C       TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
C       TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
C       IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
C       TYPE *,'QIO PARAMETER STATUS:',MSGBUF
C       MSGBUF=' '
C       ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
C       IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
C       TYPE *,'I/O STATUS:',MSGBUF
C
C       IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
C       IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
C
C       ENDIF
C         WRITE(6,111)IMAGE
111     FORMAT(1X,10(1X,O6))
cccccccccccc
c       put out the histogram to the grinnell
c
        CALL GGHIST(IMAGE)
          DO I=1,64
          DO J=1,127
          IMAGE(J,I)=IAND(IMAGE(J,I),'377'O)
          ENDDO
          IMAGE(128,I)='34015'O
          ENDDO
          CALL PIX(IMAGE)
        END
        SUBROUTINE PIX(IBUFA)
        IMPLICIT INTEGER*2 (A-Z)
        EXTERNAL IO$WRITEVBLK
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IOTBL.CMN'
        INTEGER SYS$QIOW,ITCHAN,J,IO$WRITEVBLK
        INTEGER*2 OUT(12),IBUFA(1)
        COMMON/CHAN/ITCHAN
        COMMON/BALLO/IXBW,IYBW
        DATA OUT/'17777'O,'120000'O,'107777'O,'24055'O,'26002'O,'44000'O,
        1'50002'O,'54000'O,'64000'O,'74776'O,0,0/
        OUT(11)=IXBW.OR.'44000'O
        OUT(12)=IYBW.OR.'64000'O
        J=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1OUT(1),%VAL(24),,,,)
        J=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1IBUFA(1),%VAL(16384),,,,)
        RETURN
        END
        SUBROUTINE GGHIST(IMAGE)
C ****************************************************************
C
C       FUNCTION:
C
C       THIS ROUTINE PERFORMS A HISTOGRAM ON THE IMAGE
C
C ****************************************************************
C
C       ARGUMENTS:
```

IMAGEHDEMO.FOR

```
C
C
C ************************************************************
C
C       MODULE NOTES:
C
C
C ************************************************************
C
C
C       MODULE CREATION DATE:
C
C       DEC. 1985
C
C ************************************************************
C
C       MODULE MODIFICATION HISTORY:
C
C
C ********************** EOH *********************************
C
C
        EXTERNAL IO$WRITEVBLK
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IMGTBL.CMN'
        INCLUDE 'DISK$USERDISK:[SUBIMAGE]IOTBL.CMN'
        COMMON/IMGSOURCE/IMGSOURCE       !IMAGE SOURCE STRING COMMON TO SUBCON
 SUBINIT
        CHARACTER*5 IMGSOURCE
        INTEGER*4 OPRINP
        INTEGER*4 CHECKIMG               !DUPLICATE IMAGE CHECK FUNCTION
        LOGICAL*1 DISKINPUT              !DISK/TAPE INPUT FLAG .TRUE.=DISK
 .FALSE.=TAPE
        DATA DISKINPUT/.TRUE./  !ASSUME DISK INPUT
        CHARACTER*4 CHARIN               !OPERATER RESPONSE
        INTEGER*2 IACODE                 !VARIABLE TO CONTAIN OPERATOR FUN REQ
        INTEGER*4 DSPUPD
        LOGICAL*1 IIFLG                  !REWRITE HEADER2 LOGICAL FLAG
        LOGICAL*1 TAPEDUP,OLDIMG/.FALSE./
       DIMENSION LISTFSIZE(3),LISTSPEED(3),LISTFPOS(3)
        DIMENSION LIST(8),ILIST(3),LISTMODE(2),LISTSPDT(2)
        DIMENSION MLIST(5)
        INTEGER*2 ERASEQ(15),IMAGE(NCOL+1,NROW),OUT(780)
        INTEGER HIST(256)
        DATA ERASEQ/'100000'O,'17777'O,'24240'O,'121040'O,
        1'140001'O,'121000'O,'110000'O,'107777'O,'121000'O,
        2'64000'O,'70377'O,'44000'O,'52377'O,'24040'O,'26000'O/
        I=LIB$ERASEPAGE(1,1)             !ERASE SCREEN
 C      IER = IFENCEY + IFENCEYSIZE - 1 !COMPUTE ENDING ROW FOR SUB IMAGE
 C      IEC = IFENCEX + IFENCEXSIZE - 1 !COMPUTE ENDING COL FOR SUBIMAGE
        IER=64
        IEC=64
 C      CALL MESSAGE('ENTER HISTOGRAM PLOT QUADRANT')
 C      CALL ACCEPT(IACODE)              !GET THE OPERATORS REQ KEY
 C      IF(IACODE.EQ.'0031'X)THEN
        ERASEQ(10)='64400'O     !LLA
        ERASEQ(12)='44400'O     !LEA
 C      ENDIF
 C      IF(IACODE.EQ.'0032'X)THEN
```

IMAGEHDEMO.FOR

```
C       ERASEQ(10)='64400'O
C       ERASEQ(12)='44000'O
C       ENDIF
C       IF(IACODE.EQ.'0033'X)THEN
C       ERASEQ(10)='64000'O
C       ERASEQ(12)='44000'O
C       ENDIF
C       IF(IACODE.EQ.'0034'X)THEN
C       ERASEQ(10)='64000'O
C       ERASEQ(12)='44400'O
C       ENDIF
        I=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1ERASEQ,%VAL(30),,,,)
        IFENCEY=1
        IFENCEX=1
        DO ICOL=1,256
        HIST(ICOL)=0
        ENDDO
        DO IROW=IFENCEY,IER
        DO ICOL=IFENCEX,IEC
C       PRINT *,'IMAGE(ICOL,IROW)=',IMAGE(ICOL,IROW),ICOL,IROW
        HIST(IMAGE(ICOL,IROW)+1)=HIST(IMAGE(ICOL,IROW)+1)+1
        ENDDO
        ENDDO
        LMAX=-1000000
        LMIN=1000000
C       SKIP ZERO WHEN GETTING SCALE FOR HISTOGRAM (START AT 2)
        DO ILOOK=2,256
        IF(HIST(ILOOK).GT.LMAX)LMAX=HIST(ILOOK)
        IF(HIST(ILOOK).LT.LMIN)LMIN=HIST(ILOOK)
        ENDDO
        IF(LMAX.EQ.LMIN)THEN
        TYPE *,'MAX IS THE SAME AS MIN.....!!!!!!! ERROR.....'
        RETURN
        ELSE
C       TYPE*,'MAX,MIN=',LMAX,LMIN
        ENDIF
        HIST(1)=(HIST(1)-LMIN)/(LMAX-LMIN)
        IF(HIST(1).GT.255)HIST(1)=255   !THIS TAKES CARE OF ZERO
        DO ILOOK=2,256
        HIST(ILOOK)=255.*(FLOAT(HIST(ILOOK))-FLOAT(LMIN))/
        1(FLOAT(LMAX)-FLOAT(LMIN))
        ENDDO
        IOUT=2
        OUT(1)='50000'O
        DO ILOAD=1,256
        OUT(IOUT)=ERASEQ(12)+(ILOAD-1)
        OUT(IOUT+1)=ERASEQ(10)
        OUT(IOUT+2)='72000'O+HIST(ILOAD)
        IOUT=IOUT+3
        ENDDO
        IOUT=IOUT-3
        I=SYS$QIOW(%VAL(1),%VAL(GRCHAN),%VAL(%LOC(IO$WRITEVBLK)),,,,
        1OUT,%VAL(IOUT*2),,,,)
        RETURN
        END
```

APPENDIX M

RWCMEMT.FOR

APPENDIX M

RWCMEMT.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
          INTEGER*2 ERROR,ITIMES,NWORDS
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/,ERROR/0./
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
1       do 100 itest=1,5
                DO J=1,nwords
                if(itest.eq.1)BUF(J)=J
                if(itest.eq.2)buf(j)=0
                if(itest.eq.3)buf(j)='377'o
                if(itest.eq.4)buf(j)='125'o
                if(itest.eq.5)buf(j)='052'o
                ENDDO
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO WRITE PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF

100     continue
          ITIMES=ITIMES+1
          type *,'memory tested with the above',ERROR,
        1' errors.',ITIMES,
        1' ON',NWORDS, ' LOCATIONS'
        GO TO 1
        END
```

APPENDIX N

SELDAT.FOR

APPENDIX N

SELDAT.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
          TYPE *,'ENTER DATA PATTERN TO BE USED (377)'
          READ(5,55)IDAT
55      FORMAT(O3)
                DO J=1,nwords
                buf(j)=IDAT
                ENDDO
C       SET FIRST AND LAST IN EACH LINE TO ZERO
        DO J=1,NWORDS,128
        BUF(J)=0
        ENDDO
        DO J=64,NWORDS,128
        BUF(J)=0
        ENDDO
1       ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),
        1%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO WRITE PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
```

SELDAT.FOR

```
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO READ PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
          DO I=1,NWORDS
          IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
          WRITE(6,11)I,IAND(BUF(I),'377'O),IAND(RBUF(I),'377'O)
11      FORMAT('** MEMORY R/W ERROR AT ',I4,'  INPUT=',1X,O6,
        1'     OUTPUT=',O6)
          ENDIF
          ENDDO

          ITIMES=ITIMES+1
          type *,'memory test complete with the above errors.',ITIMES,
        1' ON',NWORDS, ' LOCATIONS'
        GO TO 1
        END
```

APPENDIX O

SEQRAMP.FOR

APPENDIX O

SEQRAMP.FOR

```
C***********************************************************************
*
C
C       THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
C       ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
C       A NEGATIVE NUMBER.
C
C***********************************************************************
*
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        BYTE DAC(64)
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
        nbytes=2*nwords
        N=1
 155    TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
        READ(5,33)DAC(N)
 33     FORMAT(I2)
        IF(DAC(N).GT.0)THEN
        N=N+1
        GO TO 155
        ENDIF
        N=N-1
                DO J=1,nwords
                BUF(J)='0'O
                ENDDO
        DO I=1,N
        TYPE *,'DAC NUMBER=',DAC(I)
                DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
                buf(K)=(K-1)*2
 C              BUF(K)='377'O
                ENDDO
        ENDDO

        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
```

```
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'QIO PARAMETER STATUS:',MSGBUF
      MSGBUF=' '
      ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'I/O STATUS:',MSGBUF
      IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
      IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
      ENDIF
 1111 ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
      1IOSB,,,
      1RBUF(1),%VAL(NBYTES),,,,)
      END
```

APPENDIX P

SEQUENCE.FOR

APPENDIX P

SEQUENCE.FOR

```
 C*****************************************************************************
*
 C
 C      THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
 C      ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
 C      A NEGATIVE NUMBER.
 C
 C*****************************************************************************
*
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        BYTE DAC(64)
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
        nbytes=2*nwords
        N=1
 155    TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
        READ(5,33)DAC(N)
 33     FORMAT(I2)
        IF(DAC(N).GT.0)THEN
        N=N+1
        GO TO 155
        ENDIF
        N=N-1
                DO J=1,nwords
                BUF(J)='0'O
                ENDDO
        TYPE *,'ENTER DATA FOR DAC'
        READ(5,555)IDATA
 555    FORMAT(O3)
        DO I=1,N
        TYPE *,'DAC NUMBER=',DAC(I)
                DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
                BUF(K)=IDATA
                ENDDO
        ENDDO
        DO J=1,NWORDS,128
        BUF(J)=0
        ENDDO
        DO J=64,NWORDS,128
        BUF(J)=0
```

```
      ENDDO

      ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
      1BUF(1),%VAL(NBYTES),,,,)
      IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
      ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'QIO PARAMETER STATUS:',MSGBUF
      MSGBUF=' '
      ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'I/O STATUS:',MSGBUF
      IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
      IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
      ENDIF
 1111 ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
      1IOSB,,,
      1RBUF(1),%VAL(NBYTES),,,,)
      END
```

APPENDIX Q

SHORTLINE.FOR

APPENDIX Q

SHORTLINE.FOR

```
C***********************************************************************
*
C
C      THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
C      ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
C      A NEGATIVE NUMBER.
C
C***********************************************************************
*
       EXTERNAL IO$WRITEVBLK,IO$READVBLK
       INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
       INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
       BYTE DAC(64)
       CHARACTER*80 MSGBUF
         DATA ITIMES/0/
       ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
       IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
       NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
       nbytes=2*nwords
       N=1
C155   TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
C      READ(5,33)DAC(N)
33     FORMAT(I2)
       DAC(N)=31
C      IF(DAC(N).GT.0)THEN
C      N=N+1
C      GO TO 155
C      ENDIF
C      N=N-1
               DO J=1,nwords
               BUF(J)='0'O
               ENDDO
       I=1
C      DO I=1,N
       TYPE *,'DAC NUMBER=',DAC(I)
C              DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
C              BUF(K)='100'O
C              ENDDO
C      ENDDO
C              DO K=1+((DAC(I)-1)*128),((128+((DAC(I)-1)*128))/2)-1
C              BUF(K)=0
C  C           ENDDO
C              DO K=((128+((DAC(I)-1)*128))/2)-1,128+((DAC(I)-1)*128)
C              BUF(K)=0
C              ENDDO
```

SHORTLINE.FOR

```
C       DO I=31,8192-95,128
        DO I=35,40
        BUF(I)='377'O
        ENDDO

C       BUF(4000-128)='377'O

        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),
        1%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
 1111   ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
        1IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
        END
```

APPENDIX R

SSELDAT.FOR

APPENDIX R

SSELDAT.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
          TYPE *,'ENTER DATA PATTERN TO BE USED (377)'
          READ(5,55)IDAT
55      FORMAT(O3)
                DO J=1,nwords
                buf(j)=IDAT
                ENDDO
C       SET FIRST AND LAST IN EACH LINE TO ZERO
1       ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),
        1%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO WRITE PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO READ PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
          DO I=1,NWORDS
          IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
          WRITE(6,11)I,IAND(BUF(I),'377'O),IAND(RBUF(I),'377'O)
 11     FORMAT('** MEMORY R/W ERROR AT ',I4,'  INPUT=',1X,O6,
        1'     OUTPUT=',O6)
          ENDIF
          ENDDO

          ITIMES=ITIMES+1
          type *,'memory test complete with the above errors.',ITIMES,
        1' ON',NWORDS, ' LOCATIONS'
        GO TO 1
        END
```

APPENDIX S

SSELDAT.FOR

APPENDIX S

SSELDAT.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
          TYPE *,'ENTER DATA PATTERN TO BE USED (377)'
          READ(5,55)IDAT
55      FORMAT(O3)
                DO J=1,nwords
                buf(j)=IDAT
                ENDDO
C       SET FIRST AND LAST IN EACH LINE TO ZERO
1       ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),
        1%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO WRITE PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO READ PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
```

SSELDAT.FOR

```
      IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
      TYPE *,'I/O STATUS:',MSGBUF
      IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
      IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
      ENDIF
        DO I=1,NWORDS
        IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
        WRITE(6,11)I,IAND(BUF(I),'377'O),IAND(RBUF(I),'377'O)
 11   FORMAT('** MEMORY R/W ERROR AT ',I4,'  INPUT=',1X,O6,
      1'     OUTPUT=',O6)
        ENDIF
        ENDDO

        ITIMES=ITIMES+1
        type *,'memory test complete with the above errors.',ITIMES,
      1' ON',NWORDS, ' LOCATIONS'
      GO TO 1
      END
```

APPENDIX T

SSEQUENCE.FOR

APPENDIX T

SSEQUENCE.FOR

```
C***************************************************************************
*
C
C       THIS ROUTINE IS USED TO SELECT WHICH LEDS OR LINES IS TO BE TURNED
C       ON. SEVERAL CAN BE SELECTED. ENTER AS MANY AS YOU WANT THE ENTER
C       A NEGATIVE NUMBER.
C
C       THIS ROUTINE IS THE SAME AS SEQUENCE EXCEPT THAT IT DOESN'T ZERO OUT
C       THE LAST VALUE IN EACH ROW ON EACH LED
C
C***************************************************************************
*
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        BYTE DAC(64)
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
        NWORDS=8192      ! NUMBER OF MEMORY LOCATIONS PER REFERENCE 128X64
        nbytes=2*nwords
        N=1
 155    TYPE*,'ENTER DAC NUMBER TO TURN ON, ENTER NEGATIVE TO COMPLETE'
        READ(5,33)DAC(N)
 33     FORMAT(I2)
        IF(DAC(N).GT.0)THEN
        N=N+1
        GO TO 155
        ENDIF
        N=N-1
                DO J=1,nwords
                BUF(J)='0'O
                ENDDO
        TYPE *,'ENTER DATA FOR DAC'
        READ(5,555)IDATA
 555    FORMAT(O3)
        DO I=1,N
        TYPE *,'DAC NUMBER=',DAC(I)
                DO K=1+((DAC(I)-1)*128),128+((DAC(I)-1)*128)
                BUF(K)=IDATA
                ENDDO
        ENDDO
        ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
        1BUF(1),%VAL(NBYTES),,,,)
```

SSEQUENCE.FOR

```
        IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
        ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'QIO PARAMETER STATUS:',MSGBUF
        MSGBUF=' '
        ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
        IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
        TYPE *,'I/O STATUS:',MSGBUF
        IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
        IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
        ENDIF
 1111   ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
        1IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
        END
```

APPENDIX U

SWITCHTEST.FOR

APPENDIX U

SWITCHTEST.FOR

```
        EXTERNAL IO$WRITEVBLK,IO$READVBLK
        INTEGER*2 RBUF(8192),BUF(8192),IOSB(4)
        INTEGER SYS$ASSIGN,XTCHAN,SYS$QIOW,SYS$GETMSG
        CHARACTER*80 MSGBUF
          DATA ITIMES/0/
        ISTATUS=SYS$ASSIGN('XTA0',XTCHAN,,)
        IF(.NOT.ISTATUS)TYPE *,'ERROR IN AMD XT CHANNEL ASSIGN'
          type *,'Enter number of memory locations to test.'
          accept*,nwords
          nbytes=2*nwords
c1      do 100 itest=1,5
1       continue
                DO J=1,nwords
                buf(j)=(j-1)*2
c               if(itest.eq.1)BUF(J)=J
c               if(itest.eq.2)buf(j)=0
c               if(itest.eq.3)buf(j)='377'o
c               if(itest.eq.4)buf(j)='125'o
c               if(itest.eq.5)buf(j)='052'o
                ENDDO
C       ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$WRITEVBLK)),IOSB,,,
C       1BUF(1),%VAL(NBYTES),,,,)
C       IF(.NOT.ISTATUS.OR..NOT.IOSB(1))THEN
C       ISTATUS=SYS$GETMSG (%VAL(ISTATUS), MSGLEN, MSGBUF,,)
C       TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
C       TYPE *,' ISTATUS=',ISTATUS,'  IOSB(1)=',IOSB(1)
C       IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
C       TYPE *,'QIO PARAMETER STATUS:',MSGBUF
C       MSGBUF=' '
C       ISTATUS=SYS$GETMSG (%VAL(IOSB(1)), MSGLEN, MSGBUF,,)
C       IF(.NOT.ISTATUS) TYPE *,'ERROR IN CALL TO $GETMSG'
C       TYPE *,'I/O STATUS:',MSGBUF
C
C       IF(.NOT.ISTATUS)TYPE*,'PARAMETER ERROR IN XT OUTPUT'
C       IF(.NOT.IOSB(1))TYPE *,'I/O ERROR IN XT OUTPUT'
C
C       ENDIF
1111    ISTATUS=SYS$QIOW(%VAL(1),%VAL(XTCHAN),%VAL(%LOC(IO$READVBLK)),
        1IOSB,,,
        1RBUF(1),%VAL(NBYTES),,,,)
          DO I=1,NWORDS
          IF(IAND(BUF(I),'377'O).NE.IAND(RBUF(I),'377'O))THEN
          WRITE(6,11)I,IAND(BUF(I),'377'O),IAND(RBUF(I),'377'O)
```

SWITCHTEST.FOR

```
 11     FORMAT('** MEMORY R/W ERROR AT',O6,'  INPUT=',1X,O6,
        1'      OUTPUT=',O6)
          ENDIF
          ENDDO

 100    continue
          ITIMES=ITIMES+1
          type *,'MEMORY SWITCH test complete with the above errors.',
        1' ON',NWORDS, ' LOCATIONS'
        GO TO 1111
        END
```

```
CONP            EQU     0AF83H
PORA                EQU     0AF80H
PORB                EQU     0AF81H
PORC                EQU     0AF82H

DATA    SEGMENT PUBLIC 'DATA'
TEMP    DW      4
DATA    ENDS

DGROUP  GROUP           DATA
CODE    SEGMENT         'CODE'
        ASSUME CS:CODE,DS:DGROUP,SS:DGROUP
PUBLIC  WRITEC
WRITEC  PROC    FAR
        PUSH    BP
        MOV     BP,SP
                CLI

                MOV     DX,CONP
                MOV     AL,10   ; RESET READ. PIN 12,PC5
                OUT     DX,AL
                MOV     AL,8    ; RESET READY. PIN 13
                OUT     DX,AL

                MOV     DX,PORA

                LES     BX,DWORD PTR [BP+10]    ; ADDRESS OF PARAM 1 ES:[BX]
                MOV     CX,ES:[BX]
                MOV     TEMP,CX

                LES     BX,DWORD PTR [BP+6]     ; ADDRESS OF PARAM 2 ES:[BX]

                MOV CX,0

NEXT:
                MOV     AL,ES:[BX]              ; VALUE OF PARAM 1 IN AL

                OUT     DX,AL
                INC     BX
                INC     BX
                INC     BX
                INC     BX                      ; INCREMENT DATA ADDRESS
                INC     CX
                CMP     CX,TEMP
                JNE     NEXT

                MOV     DX,CONP
                MOV     AL,9            ; SET READY PIN 13
                OUT     DX,AL


        MOV     SP,BP
        POP     BP
        RET     08H
        WRITEC ENDP
        CODE ENDS
        END
```

```
CONP            EQU     0AF83H
PORA            EQU     0AF80H
PORB            EQU     0AF81H
PORC            EQU     0AF82H

DATA    SEGMENT PUBLIC 'DATA'
TEMP2   DW      0
DATA    ENDS

DGROUP  GROUP           DATA
CODE    SEGMENT         'CODE'
        ASSUME CS:CODE,DS:DGROUP,SS:DGROUP
PUBLIC  READC
READC   PROC    FAR
        PUSH    BP

        MOV     BP,SP
                CLI
                MOV     DX,CONP

                MOV     AL,11   ; SET READ. PIN 12
                OUT     DX,AL
                MOV     AL,8    ; reSET READY LINE. PIN 13
                OUT     DX,AL
                MOV     AL,9
                OUT     DX,AL
                MOV     CX,0
WAIT:
                INC     CX
                CMP     CX,25
                JB      WAIT

                LES     BX,DWORD PTR [BP+10]    ; ADDRESS OF 1ST PARAM
                MOV     CX,ES:[BX]
                MOV     TEMP2,CX                ;STORE NUMBER TO READ
                LES     BX,DWORD PTR [BP+6]     ; ARRAY ADDRESS
                MOV     CX,0                    ; INITIALIZE COUNTER
                MOV     AL,8
                OUT     DX,AL
CHECK:
                MOV     DX,PORC
CHECK2:
                IN      AL,DX

                CMP     AL,32

                JZ      CHECK2
FIRST:
                MOV     DX,PORB
                IN      AL,DX

                MOV     ES:[BX],AL

                INC     BX
                INC     BX
                INC     BX
                INC     BX
                INC     CX
                CMP     CX,TEMP2
                JB      CHECK


                MOV     DX,CONP
```

```
          MOV     DX,0
          MOV     AH,0

MOV     SP,BP
POP     BP
RET     08H

READC ENDP
CODE ENDS
END
```

```
CONP              EQU      0AF83H
PORA              EQU      0AF80H
PORB              EQU      0AF81H
PORC              EQU      0AF82H

DATA     SEGMENT PUBLIC 'DATA'
DATA     ENDS

DGROUP   GROUP             DATA
CODE     SEGMENT           'CODE'
         ASSUME CS:CODE,DS:DGROUP,SS:DGROUP
PUBLIC   INITC
INITC    PROC     FAR
         PUSH     BP

         MOV      BP,SP
                  CLI
                  MOV      DX,CONP
                  MOV      AL,167
                  OUT      DX,AL
         MOV      SP,BP
         POP      BP
         RET      00H

         INITC ENDP
         CODE ENDS
         END
```

```
DATA     SEGMENT PUBLIC 'DATA'
DATA     ENDS

DGROUP   GROUP            DATA
CODE     SEGMENT          'CODE'
         ASSUME CS:CODE,DS:DGROUP,SS:DGROUP
PUBLIC   IAND
IAND     PROC      FAR
         PUSH      BP

         MOV       BP,SP
         LES       BX,DWORD PTR [BP+6]
         MOV       AL,ES:[BX]
         MOV       AH,0
         MOV       DX,0
         MOV       SP,BP
         POP       BP
         RET       04H

         IAND ENDP
         CODE ENDS
         END
```

```
CONP            EQU     0AF83H
PORA            EQU     0AF80H
PORB            EQU     0AF81H
PORC            EQU     0AF82H

DATA    SEGMENT PUBLIC 'DATA'
DATA    ENDS

DGROUP  GROUP           DATA
CODE    SEGMENT         'CODE'
        ASSUME CS:CODE,DS:DGROUP,SS:DGROUP
PUBLIC  LOOP
LOOP    PROC    FAR
        PUSH    BP

        MOV     BP,SP
                CLI
                MOV     DX,CONP
                MOV     AL,11    ; SET READ. PIN 12
                OUT     DX,AL
                MOV     AL,9     ; SET READY LINE. PIN 13
                OUT     DX,AL

                MOV     DX,PORB
                IN      AL,DX


                MOV     DX,PORC
CHECK:
                IN      AL,DX
                CMP     AL,48
                JZ      CHECK

                MOV     DX,0
                MOV     AH,0

        MOV     SP,BP
        POP     BP
        RET     08H

        LOOP ENDP
        CODE ENDS
        END
```

```
$include:'\forintf.h'
        PROGRAM KEYPEAK
        INTEGER*2 IV,IN,ic,iy,ix,ival
        integer*2 x1,x2,y1,y2,val,ipeak
        integer*4 value,buffer(256),posx(100),posy(100)
        character BUF(256),TEMPC
        INTEGER*2 TEMP
        INTEGER*2 MAP,COLOR,START,LENGTH
        EQUIVALENCE (TEMP,TEMPC)
        DATA MAP,COLOR,START,LENGTH/3,2,0,256/
        i=init(620)
        call chan(2)
c       call auto
        call sync(1)
c       call snap(1)
        CALL CGRAB(1)
        CALL LUTM(MAP)
1       write(*,'(40H ENTER MAXIMUM MAPPING THRESHOLD.(0-255))')
        READ(*,*)IPEAK
        do 209 iy=1,256
        IF(IY-1.LT.IPEAK)THEN
        TEMP=IY-1
        BUF(IY)=TEMPC
        ELSE
        TEMP=255
        BUF(IY)=TEMPC
        ENDIF
209     continue

        CALL LUTD(MAP,COLOR,START,LENGTH,BUF)
        GO TO 1
C       call pexit
C       stop
        end
```

```
$include:'\forintf.h'
$LARGE
        PROGRAM CREADI
        EXTERNAL INITC,READC
        INTEGER  INITC,READC
        INTEGER*2 IV,IN,ic,iy,ix,ival
        integer*2 x1,x2,y1,y2,val,ipeak
        integer*4 value,buffer(256),posx(100),posy(100)
        INTEGER DAT(8192),INUM
        I=INITC()
        INUM=8192
        I=READC(INUM,DAT)
        WRITE(*,'(22H AFTER REFERENCE READ.)')
        i=init(620)
        ival=2
        call chan(ival)
        ival=1
        call sync(ival)
        call quadm(1)
        call dquad(0)
        X1=0
        Y1=0
        X2=511
        Y2=511
        CALL RECT(X1,Y1,X2,Y2)
        DO 109 IY=1,64
        DO 108 IX=1,128
        VALUE=DAT(IX+(IY-1)*128)
        call pixw((ix-1)*2,(iy-1)*2,value)
        call pixw((ix-1)*2,((iy-1)*2)+1,value)
        call pixw(((ix-1)*2)+1,((iy-1)*2)+1,value)
        call pixw(((ix-1)*2)+1,(iy-1)*2,value)
108     continue
109     continue
        write(*,'(18H IMAGE ON DISPLAY.)')

        call pexit
        stop
        end
```

```
$include:'\forintf.h'
$LARGE
        PROGRAM STOREIMG
        EXTERNAL INITC,READC,ITODSK
        INTEGER  INITC,READC
        INTEGER*2 ITODSK,ISTATUS
        INTEGER*2 IV,IN,ic,iy,ix,ival
        integer*2 x1,x2,y1,y2,val,ipeak
        INTEGER*2 BSIZE,QUAD
        CHARACTER*13 FNAME
        CHARACTER WORKBUFFER(4096)
        integer*4 value,buffer(256),posx(100),posy(100)
        INTEGER DAT(8192),INUM
        DATA BSIZE/4096/
        I=INITC()
        INUM=8192
        I=READC(INUM,DAT)
        WRITE(*,'(22H AFTER REFERENCE READ.)')
        i=init(620)
        ival=2
        call chan(ival)
        ival=1
        call sync(ival)
        call quadm(1)
        call dquad(0)
        X1=0
        Y1=0
        X2=511
        Y2=511
        CALL RECT(X1,Y1,X2,Y2)
        DO 109 IY=1,64
        DO 108 IX=1,128
        VALUE=DAT(IX+(IY-1)*128)
        call pixw(ix-1,iy-1,value)
108     continue
109     continue
        write(*,'(18H IMAGE ON DISPLAY.)')
        FNAME='REFER.IMG'
        ISTATUS=ITODSK(BSIZE,QUAD,FNAME,WORKBUFFER)
        call pexit
        stop
        end
```

```
C.........................................................................
C
C       THIS ROUTINE IS THE CORRELATOR REFERENCE MEMORY READ/WRITE
C       TEST ROUTINE
C
C.........................................................................
$LARGE
        PROGRAM RWCMEM
        PROGRAM MAIN
        EXTERNAL READC,WRITEC,IAND,INIT
        INTEGER INUM,LOOP,READC,WRITEC,IAND,INIT
        INTEGER DAT(8192),DAT2(8192)

        DO 2 I=1,8192
        DAT(I)=I
C       DAT(I)=255
2       CONTINUE

        I=INITC()
        INUM=8192
1       CONTINUE
        I=WRITEC(INUM,DAT)
        I=READC(INUM,DAT2)
        DO 100 I=1,INUM
        II=IAND(I)
        IF(DAT2(I).NE.II)WRITE(*,'(1X,2I6)')II,DAT2(I)
100     CONTINUE
        WRITE(*,'(36H COMPLETE WITH THE ABOVE DIFFERENCES)')
        GO TO 1

        END
```

```
$include:'\forintf.h'
$LARGE
        PROGRAM DOWNIMG
        EXTERNAL INITC,READC,ITODSK,IFRDSK,WRITEC
        INTEGER  INITC,READC,IFRDSK,WRITEC
        INTEGER*2 ITODSK,ISTATUS
        INTEGER*2 IV,IN,ic,iy,ix,ival
        integer*2 x1,x2,y1,y2,val,ipeak
        INTEGER*2 BSIZE,QUAD
        CHARACTER*13 FNAME
        CHARACTER WORKBUFFER(4096)
        integer*4 value,buffer(256),posx(100),posy(100)
        INTEGER DAT(8192),INUM,IMAGE(128,64)
        EQUIVALENCE(DAT,IMAGE)
        DATA BSIZE/4096/,QUAD/0/

        i=init(620)
        ival=2
        call chan(ival)
        ival=1
        call sync(ival)
        call quadm(1)
        call dquad(0)
        X1=0
        Y1=0
        X2=511
        Y2=511
        CALL RECT(X1,Y1,X2,Y2)
        FNAME='REFER.IMG'
        ISTATUS=IFRDSK(BSIZE,QUAD,FNAME,WORKBUFFER)
        DO 109 IY=1,64
        DO 108 IX=1,128
        VALUE=IpixR(ix-1,iy-1)
        IMAGE(IX,IY)=VALUE
108     continue
109     continue
        write(*,'(19H DOWNLOADING IMAGE.)')
        I=INITC()
        write(*,'(13H AFTER INITC.)')
        INUM=8192
        I=WRITEC(INUM,DAT)
        WRITE(*,'(19H DOWNLOAD COMPLETE.)')
        end
```

```
$include:'\forintf.h'
        PROGRAM RTIME
        INTEGER*2 STATE,CHANNEL,MODE
        STATE=1
        MODE=1
        CHANNEL=2
        CALL CGRAB(MODE)
        CALL SYNC(MODE)
        CALL CHAN(CHANNEL)
        END
```

```
C.........................................................................
C
C       THIS ROUTINE READS CORRELATOR REFERENCE MEMORY AND COMPARES IT TO
C       AND INCREASING SEQUENCE
C
C.........................................................................

        PROGRAM RCMEM
        EXTERNAL INITC,READC
        INTEGER INUM,INITC,READC
        INTEGER DAT(8192)

        I=INITC()
        INUM=5
        READ(*,'(I4)')INUM
        write(*,'(11H Starting..)')
1       CONTINUE
        I=READC(INUM,DAT)
        DO 3 I=1,INUM
c       IF(I.LT.5)WRITE(*,'(1X,6H**OK**,2I6)')I,DAT(I)
        II=IAND(I)
        IF(DAT(I).NE.II) WRITE(*,'(1X,2I6)')II,DAT(I)
3       CONTINUE
        write(*,'(1x,36H complete with the above differences)')
        GO TO 1

        END
```

```
$include:'\forintf.h'
C
C       THIS ROUTINE IS USED TO STOP THE FRAME BUFFER IMAGE FROM BEING
C       WRITTEN CONTINUOUSLY
C
        PROGRAM STOP
        INTEGER*2 STATE
        STATE=0
        CALL CGRAB(STATE)
        call snap(1)
        END
```

```
$include:'\forintf.h'
        PROGRIM HISTO
        integer*4 value,buffer(256)
        i=init(620)
        call chan(2)
        call sync(1)
        call snap(1)
        value=ihisto(buffer)
        call dhisto(value,30.470,200,0,0,buffer)
        call pexit
        stop
        end
```

```
$include:'\forintf.h'
        PROGRAM PEAK
        INTEGER*2 IV,IN,ic,iy,ix,ival
        integer*2 x1,x2,y1,y2,val,ipeak
        integer*4 value,buffer(256),posx(100),posy(100)
        character*1 box
218     format(a1)
        i=init(620)
        call chan(2)
        call auto
        call sync(1)
        call snap(1)

C       value=0
C       do 109 iy=1,512
C       do 108 ix=1,512
C       call pixw(ix,iy,value)
C108    continue
C109    continue
C       IX=256
C       IY=256
C       VALUE=100
C       CALL PIXW(IX,IY,VALUE)
C       write(*,'(16H AFTER WRITING..)')

        ipeakcnt=1
        ipeak=-255
        do 209 iy=1,512
        do 208 ix=1,512
        ival=ipixr(ix,iy)
        if(ival.gt.ipeak)then
        ipeak=ival
        posx(ipeakcnt)=ix
        posy(ipeakcnt)=iy
        endif
c       write(*,*) ix,ival
208     continue
209     continue
        write(*,*)ipeak,posx(1),posy(1)
        call pexit
        stop
        end
```

```
C.....................................................................
C
C       THIS ROUTINE IS USED TO WRITE AN INCREASING SEQUENCE TO THE
C       CORRELATOR REFERENCE MEMORY
C
C......................................................................

        PROGRAM WCMEM
        EXTERNAL WRITEC,INITC
        INTEGER INUM,WRITEC,INITC
        INTEGER DAT(8192)

        DO 2 I=1,8192
        DAT(I)=I
C       DAT(I)=255
2       CONTINUE

        I=INITC()
        INUM=8192
1       CONTINUE
        I=WRITEC(INUM,DAT)
        WRITE(*,'(1X,/,3(1X,I6))')I,INUM,DAT(1)
        GO TO 1

        END
```

```
C.....................................................................
C
c       This routine is used for loading a contant into correlator reference
c       memory.
C
C.....................................................................

        PROGRAM SELDAT
        EXTERNAL WRITEC,INITC
        INTEGER INUM,WRITEC
        INTEGER DAT(8192)
        write(*,'(41H ENTER DATA VALUE TO BE LOADED (0 - 255).)')
        read(*,'(I3)')IDAT
        DO 2 I=1,8192
        DAT(I)=IDAT
C       DAT(I)=255
2       CONTINUE

        I=INITC()
        INUM=8192
1       CONTINUE
        I=WRITEC(INUM,DAT)
        WRITE(*,'(1X,/,3(1X,I6))')I,INUM,DAT(1)
        GO TO 1

        END
```

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